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"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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TOWN SEWAGE

ONE of the most imperative requirements of social life is some means of dealing with those waste products of the human mechanism which are dirt only while they remain out of their proper place, but are capable of becoming a source of serious inconvenience and injury whenever they are allowed to accumulate in the neighbourhood of dwellings, especially in densely populated places. In the case of isolated dwellings, and where the population is scattered, no great difficulty would be experienced in devising simple measures for disposing of this refuse so as to meet all requirements. But wherever the population is concentrated, the difficulty of dealing with house refuse, so as to prevent its becoming a nuisance, and, at the same time, to make it useful, is greatly increased. Partly on this account, and partly because neglected accumulations of house refuse are in the highest degree detrimental to health, the measures adopted in towns for dealing with house refuse have been subjected to the control of the municipal authorities, instead of being left to the option of the individual occupiers of houses; and in modern times it has come to be regarded as one of the first duties of such bodies to provide for the disposal of house refuse so as to preserve the health and life of the populations under their care. This sanitary axiom has indeed been forced into recognition by the ravages of epidemic disease, such as plague, fever, or cholera, and it may now be deemed unquestionable, except where ignorance overcomes intelligence, or where mistaken notions of economy prevail.

On sanitary grounds it has been decided, or, to say the least, very generally admitted, that the most efficient mode of dealing with house refuse is to remove it at once from dwellings, and by means of a copious use of water to sweep it away through underground channels outside of towns. In this way the domestic nuisances that were familiar during the early part of this century have been done away with, the town nuisance that arose from the use of cesspools has been suppressed, and the sanitary state of towns has generally been improved. But the removal of those nuisances has given rise to another one, affecting not only individual dwellings and towns, but the whole country. The continuous discharge of vast quantities of house refuse, distributed through great volumes of water into rivers and streams that are often sources of water-supply for domestic use, has rendered them so foul that this result of sanitary improvements is acknowledged to be a national nuisance, and one of the very highest importance in regard to public health.

Hence has arisen the question, What is to be done with town drainage? And this question still perplexes the Government, municipal authorities, river conservancies, and legal tribunals. In many instances the sanitary works carried out in towns at vast expense have given rise to serious nuisances at places lower down the streams into which the sewage is discharged; in other cases the execution of such works is prevented by prohibition against the discharge of sewage, and in some cases practices in direct opposition to legal enactment are tolerated because no remedy seems applicable.

So much for the difficulties attending the municipal object for getting rid of house refuse. It is now necessary to consider the subject in another light, and inquire what is the "right place" where house refuse is no longer to be regarded as dirt, but as material of value? How is it not only to be got rid of, but also turned to account and made useful? For this purpose it must be remembered that this waste material consists of the portions of our food which have done their work in the process of nutrition, and those portions of it which were not required in that process. In both cases plants are the source from which the constitutent parts of this material have been derived. Those plants again have abstracted them from the land on which they grew, not accidentally, but as an essential condition of their growth. Here, then, in this fact that the constituents of house refuse are essential for the growth of plants, lies the key to the sewage problem, a possibility for the utilisation of town sewage. Thousands of tons of the same substances that are constituents of house refuse are annually imported into this country for use as manure in agriculture—ammonia in the guano from Peru; phosphates, or bones and phosphatic minerals, from all parts of the world; potash from South America and Germany. Thousands of acres of land lie unproductive from want of these substances, and some of their most important sources are only of limited duration. Meanwhile the aggregate intrinsic value of those constituents in the house refuse of this country amounts to several millions annually.

There are, however, serious difficulties to be overcome before the economic object of utilising town sewage as manure in agriculture can be realised so as to fulfil all requirements involved in the municipal object of getting rid of it, and in the still more important sanitary object of preventing it from becoming a source of injury to the public health. These difficulties arise chiefly from the enormous dilution of the sewage, partly by the use of water for removing house refuse, and partly by the admixture of surface water and subsoil drainage. Generally speaking, the constituents of town sewage which have an intrinsic value as manure are so much diluted that a quantity of them which would be worth one shilling in the state of a dry solid like guano or bones, containing only a small proportion of less valuable admixture, is in sewage mixed with from six to ten tons weight of water. Therefore, in order to give land an ordinary dressing of manure in the form of town sewage, it is necessary to apply a very large bulk of that liquid. This can very often be done without any great trouble, especially when the town from which the sewage is discharged lies high, and is surrounded by cultivated land at a lower level; and even when this is not the case, the cost of pumping the sewage to a sufficient height, and the outlay for pumping works, would not generally be a serious obstacle to the application of town sewage as manure. However, the getting rid of sewage involves its continuous daily application to land; and here the municipal object is at variance with the agricultural object, of using the sewage only when it is wanted. Consequently, it would be necessary, in organising a general system of sewage utilisation, to establish a new system of farming; to grow crops specially suited for the frequent application of very dilute liquid manure, and to have the land laid out for cropping in such a manner that there may always be a

sufficient area available for disposing of the sewage day by day. Innovations of such a kind are exceedingly difficult to introduce into an art like agriculture, that is practised so much under the influence of tradition and habit; but, in addition to this impediment, there is the more serious one of cost to be incurred in adapting a farm for sewage irrigation. For the farmer, the value of town sewage is to be estimated, not by the intrinsic worth of the substances it contains, but by the amount of those substances which are effective, or at least likely to be effective, in augmenting the produce of his land after due allowance for the influence of season. If sewage containing in each ton twopence-worth of manure be applied to land in such proportion that only one-fourth of the aggregate quantity of manure constituents remain in the land or become effective, then the sewage so applied cannot be worth more than one-halfpenny per ton to the farmer.

It is therefore futile to estimate by calculation, as has often been done, the value of the sewage discharged from a town, and to anticipate, on such a basis, the possibility of making the sewage a source of considerable revenue to the town. Speculations of this kind have naturally eventuated in disappointment and the disgust of all who have been misled by them, without making due allowance for the drawbacks that influence the value of sewage as manure even more than the intrinsic worth of its constituents.

Another circumstance to be taken into account in this respect is the outlay requisite for conveying sewage from the sewer outlets where it is discharged from a town to the land where it can be utilised as manure. Even under the present system of agriculture, farmers would often be glad to have the command of town sewage for application to their land during dry seasons, when the total failure of a crop might be thus obviated. But it rarely happens that this is practicable, owing to the want of any channel of communication between the sewer outlets and the land where it would be useful. Farmers, and even landowners, would rarely be in a position to incur the expense of making such communications, and municipal authorities refuse to do it as being beyond their province. However, if the importance of preventing the pollution of rivers and watercourses were fully appreciated in regard to its influence on public health, there is much reason to believe that the obligation of getting rid of town sewage appertaining to municipal bodies really extends far beyond merely discharging it into a neighbouring stream, and involves a considerable contribution on their part, according to local conditions, towards the outlay necessary for combining the attainment of their special object with that of the farmer by getting rid of the sewage in such a manner that it may be made useful.

It would, at present, be almost impossible to suggest how this object should be realised; for if town sewage is to be applied on the same principle as manure like guano or bones, only in such proportion as to give the requisite dressing of manure constituents per acre of land, the area over which the sewage of a large town would have to be distributed would be enormous, and the attendant expenses of its distribution would be very large. If, on the other hand, the area of land to which the sewage is applied be limited so as to dispose of the largest possible proportion of sewage and keep the cost of arrangements for distribution within the smallest bounds, there would generally be such a disproportion between the actual quantity of manure constituents applied per acre and the possible effect produced on the produce of the land, that the value of the sewage as manure would be greatly diminished; or, in other words, very much of it would be wasted, and still simply got rid of.

Here again sanitary considerations demand attention, and the possible influence which the application of town sewage to land may have on the public health must be taken into account. It is, for instance, indispensable that the use of town sewage in agriculture should be conducted in such a way as to be an effectual remedy for that pollution of rivers which has become a serious national evil. Moreover, if sewage-irrigated farms are to be distributed throughout the country in the neighbourhood of towns, it is still more imperative to know that the adoption of this course will not be productive of injury to the public health. This point should receive the fullest elucidation before any general measures can be taken with the object of utilising town sewage, and the conditions under which that can be effected without risk should be thoroughly investigated.

Such an inquiry would comprise many questions of detail, requiring varied skill, and considerable time as well as labour, for its prosecution; and the British Association Committee that contemplates carrying it out, impressed with the magnitude and importance of the task, has felt the necessity of much larger means for conducting the inquiry than that small sum which the Association were able to grant for the purpose of meeting the expenses of preliminary work. If municipal bodies and landowners respond to the application of the Committee in a manner commensurate with their interest in this subject, and provide adequate funds for thorough investigation, there is reason to expect some considerable step will have been made towards placing the question of sewage disposition and utilisation in a more satisfactory position than it has yet attained.

Besides the main points already mentioned, of getting rid of sewage and turning it to account, there are yet other questions of moment to be considered. The rapid adoption of reformatory methods, in regard to the sanitary state of towns, which has marked the past quarter of a century, has not always been attended with so much improvement as might have been desired. In some instances, serious anomalies have presented themselves in this respect, and there is much reason to believe that circumstances yet remain to be provided for which affect the sanitary state of towns. Mr. Bailey Denton has recently called attention to this matter by pointing out in his letters to the *Times* the fact that, in some instances, the sewerage works of towns have been constructed in such a way as to admit of the soil surrounding the sewer being permeated by sewage, and he has suggested, as a possibility deserving of inquiry, that in this way an effect may be produced similar to the infiltration of house refuse from cesspools into the surrounding soil. If such be the case, it would perhaps account for the fact that in some towns, where every kind of known sanitary precaution has been taken, the reduction of disease and mortality has been but slight. Such an action, though slower than in the case of infiltration from cesspools, would not be less sure in its influence on the sanitary

state of a town, and in that way sewered towns may still be exposed to the evils arising from "excrement-sodden soil" which the Medical Officer of the Privy Council has pronounced to be one of the main causes of cholera and fever.

Another point in which there is reason to believe existing sanitary arrangements are defective is the facility of communication between sewers and the dwellings from which they are intended to convey refuse. Some connection of the kind is indispensable for the use of water as a transporting vehicle for the refuse; but little attention has yet been paid to the fact that the very arrangement which facilitates the water-carriage of refuse also favours the regurgitation of foul gases from the sewers into streets and dwellings. The water traps and syphons commonly attached to the connections between houses and sewers are seldom or never sufficient to prevent the passage of gases; and in this way the inhabitants of sewered towns may be exposed to the unwholesome influence of a constant pollution of the atmosphere as pernicious in its action as the use of water polluted with drainage from cesspools, or living over an excrement-sodden soil, has long been recognised to be.

These are some of the chief points which the limits of the present article will admit of being noticed as being comprised in the inquiry to be carried out by the British Association Committee. BENJAMIN H. PAUL

SCIENCE FOR CHILDREN

THE schoolmasters of the present day may be divided into two categories: those who *teach*, and those who *hear lessons;* the latter class, unfortunately for the next generation, being by far the more numerous. The mischief done to the community generally by the shortcomings of inefficient teachers is too well known to every one who has pierced below the surface of the great question of middle-class education. The difficulties, however, that beset a science teacher in his endeavours to force scientific truths into the unwilling and unprepared minds of boys, who have been subjected to the sway of these same lesson-hearers, can only be realised by those who have gone through the task. The case of a senior science class, which has been under my charge for some months past, will illustrate my meaning most fully. It consists of about a dozen boys, whose ages range between fourteen and seventeen years, and they receive twice a week an hour's instruction on chemistry and physics. The class may be divided into two distinct portions by a perfectly sharp line. Four of the boys have had the advantage of six or seven years' training under the principal of the school, who is not only a ripe scholar, but also an efficient teacher—a very rare collocation in these days. The rest have simply learnt lessons all their lives. The four boys who have been *taught* are as mentally distinct from the others, as if they were different species of the same genus. The first four are bright, attentive, wide-awake—I know of no other term to express exactly what I mean—logical, and clear-headed; they can fairly follow a chain of scientific reasoning, and reproduce it afterwards link by link; they have a certain power of induction and deduction, although of course, being new to science, this power is necessarily only just awakened; they can connect and correlate facts and ideas, they can enumerate a series of phenomena in logical sequence; in a word, although their industry and application are far from colossal, the task of teaching them the truths of natural science is a comparatively easy one. The other boys, as I have said before, almost form a distinct mental species. They cannot understand the possibility of learning anything without the aid of a book, and the idea of finding out anything for themselves has never entered their heads. Still they are far from stupid boys, being all possessed of good average brains; yet their faculties have not merely been allowed to remain undeveloped, but they have been utterly entangled, stunted, and stultified by what Dr. Frankland would call their "previous school contamination." These boys, it must be understood, are the sons of parents belonging to the upper stratum of the middle class, and have mostly been to schools conducted by university men with honourable initials appended to their names—men, in fact, who are scholars but emphatically no teachers. Their great fault is a total want of mental method, without which the greatest brain is as nought. They are at home in Virgil and Horace, some of them are fair Greek scholars; they have "been through" Euclid, and can work moderately difficult algebraical problems in a certain mechanical fashion; they are well acquainted with the leading facts of English history, and know the exact position and population of Adrianople; but as far as real mental power goes, any poor boy, who has been in a National school for three years, would beat them hollow.

These facts surely point out the absolute necessity of beginning scientific training at a very early age; and I fancy this necessity has not been sufficiently dwelt upon in the numberless essays, letters, lectures, and evidence on the subject of scientific education with which we have been deluged during the past decade. There seems to have been a notion abroad, that scientific teaching should not be begun before the age of 12 or 14; but why, I would ask, should boys' minds be allowed to remain fallow during all these years? The minds of boys of 7 and 8 should surely be as carefully developed as those of their seniors, and there is certainly no means of pure mental culture so successful as scientific teaching. A boy of this age should not be taught science so much for the sake of acquiring a certain number of facts, as of developing his powers of observation and reasoning, and giving a proper tone to his mental faculties. A boy of 8 or 9 takes a morning canter of three or four miles on his pony, not for the purpose of getting over some 7,000 yards of ground, but to strengthen his muscles and improve his carriage: his science lesson should be an intellectual canter, taken with the view to strengthening and improving his mental muscles and carriage.

In National and British Schools, and in some few middle-class schools conducted on rational principles, this great want is supplied by what are known as "Object Lessons." A natural object, such as a piece of lead or sugar, is placed before the class, and its physical properties are described by the pupils with the aid of questions from the teacher. Its origin and manufacture are also given in the case of the older children, and the whole is noted down on the black-board in as condensed a manner as possible; the lesson being reproduced in a miniature form either *viva voce* or in writing. These lessons are

most excellent in their way; but as generally taught, they are too desultory and unsystematic to effect fully their intended purpose. The principal manuals on the subject show a want of arrangement and system, that greatly detracts from their value. One day the children are supposed to learn a lesson on a piece of iron: the next on a flower, the third on a shell, and so on. Too much stress is laid upon cultivating the powers of observation, and too little on connecting the facts observed, and drawing conclusions from them. The lessons, too, are very frequently unconnected with each other, and the facts taught lean almost too much towards the practical and economic side of knowledge, and too little to that of systematic science. Great scientific ignorance is displayed in many cases: for instance, one book informs us that plumbago is an ore of iron; that iron is generally found as an oxide in combination with *sulphuric* and carbonic acid; that fluor spar is composed of fluoric acid and lime; and that lime unites with various proportions of carbonic acid. These mistakes are the result of imperfect scientific knowledge, and may be passed over for the sake of the valuable instruction given to teachers, which cannot fail to produce most excellent results, if applied to systematic scientific teaching.

It may be urged that children of 8 or 9 are too young for systematic science teaching, but facts prove the contrary. An ordinarily intelligent boy or girl of this age is perfectly capable of understanding the broad differences between the animal, vegetable, and mineral kingdoms; that there are more gases than one in the world; that some of them are colourless, while others are brown or green; that some burn and others do not; that some plants grow from the inside, while others grow from the outside; that some animals have jointed backbones, that others have their bones outside their bodies, while others have none at all. Facts such as these are perfectly comprehensible to children even younger than those I have named. During the first two years of a child's school life, after he has learned to read and write, he should be carried through the whole range of physical science in a systematic manner. The fundamental truths of chemistry and physics should be first taught him: all theoretical considerations being left aside. As few definitions as possible should be given, the whole task of the teacher at the commencement being to cultivate the child's powers of observation to the utmost. Gradually the powers of induction and deduction may be developed, facts and phenomena should be compared, and conclusions drawn from them. Order in thought and description should be specially insisted upon, and occasional retracings of the ground already gone over should take place. The objects of this preliminary science teaching should be twofold: first and foremost, to train the mind and form the judgment; and secondly, to give the child a general idea of the object and scope of the natural sciences. At the age mentioned, the faculties are all fresh, and in full process of development; and such is the desire to exercise them in intelligent children, that their thoughts often run wild. There is nothing a child likes so much as investigation, or "finding out all about things," as he himself would phrase it. The boy in the nursery rhyme who cut the bellows open to see where the wind came from, is a type of his class. Unfortunately at the present time, scientific teachers for children are extremely rare, but let the want once arise, and the demand will soon be met. We have plenty of scientific teachers and lecturers for boys and men, but the child has hitherto been left out of consideration. Teachers, in the true sense of the word, are every day on the increase, and even the old-fashioned schoolmasters are beginning to see very plainly that they must alter their system of instruction, and yield to the pressure of the times. But it is not only upon these that I would urge the necessity of beginning science teaching at the earliest possible period, but also upon those who have already adopted science as part of the ordinary school curriculum for the older boys.

CHARLES W. QUIN

THE GOLD FIELDS OF VICTORIA

The Gold Fields and Mineral Districts of Victoria. By R. B. Smyth. (Melbourne: J. Ferres. London: Trübner and Co.)

I.

TWENTY short years ago, the territory of Southern Australia comprised within the colony of Victoria offered comparatively little attraction to the emigrant. Its population had increased but slowly during the half century which had passed away since the discovery of Port Phillip Bay. Graziers, shepherds, and farmers were its chief occupants, and by them the value of its soil was estimated very much according to the number of cattle or of sheep which each acre could maintain. But to-day everything is changed. The land is dotted with hamlets, villages, and towns, and is intersected with roads and railways. The population has increased from 77,000 in 1851, to 660,000 in 1867. In the former year only 57,000 acres were under cultivation, in the latter the area had risen to 631,000. This growth in the population has been accompanied by a corresponding increase in the value of the imports and exports, which are now ten times what they were; while the value of rateable property in town and country districts is estimated at about £42,000,000.

This marvellously rapid rise of the colony is mainly to be ascribed to the discovery of gold there in 1851. Never had the prospects of the colony been gloomier than just before that discovery was made. The able-bodied part of the population was moving off to the gold-fields of New South Wales, glowing accounts of which appeared from week to week in the newspapers. Every kind of property was sinking in value. At last, after small finds of gold had been reported from different parts of Victoria, a public meeting of the citizens of Melbourne was convened, for the purpose of raising funds towards offering a reward to any one who should discover a workable gold mine within twenty miles of that town. The attention of the colonists was now thoroughly roused, and in the course of a few weeks reports came from many of the surrounding districts that gold existed in large quantities. From that time the tide of emigration from the colony was arrested, and the population began to increase with that wonderful rapidity just alluded to.

From the very beginning of the mining operations they were regulated and inspected by the Colonial Government. A mining department was instituted, with a responsible minister at its head. Mining registrars and surveyors, wardens of mining districts, and other officials were appointed with the view of aiding and regulating the labours

of the miners, and collecting every variety of information for the use of the Government. More than this, a geological survey was established, under the direction of one of the ablest of the staff of the Geological Survey of the United Kingdom, Mr. Selwyn; and funds were furnished for the production of maps, sections, and other publications necessary for elucidating the geological structure of the colony. That survey has done excellent work, the real value of which may possibly not be understood in the colony for some years to come. We cannot but regret, therefore, that in a spirit of parsimony the colonial Parliament has recently abolished the survey, and deprived the colony of the great advantage of obtaining accurate information as to the mineral tracts which remain yet to be explored. Nevertheless, for what has already been done to develop her mineral resources, and to gather accurate information regarding the structure of the rocks, and the distribution of gold, the colony may be very heartily congratulated.

The handsome volume, whose title heads this article, tells the story of the rapid rise of Victoria. It is a large thick octavo, beautifully printed, and embellished with many woodcuts, sections, and plans of singular excellence, the whole having been prepared and executed in Melbourne. Mr. Brough Smyth, Secretary for Mines to the colony, seeing the want of any trustworthy account of the gold-fields of that region, and having himself peculiar advantages for the task, proposed to himself to compile a narrative of all that was known regarding the mineral districts, the different modes in which the gold occurs, and the various methods in use for obtaining it. He has carried out the project with most commendable patience, and has produced a volume about the Victorian mines which is itself quite a mine of information both to the practical digger and to the geologist.

After a brief introduction, in which the author traces the successive steps which led to the commencement and prosecution of his work, he sketches the general topographical and geological features of the mineral districts. He then briefly describes the circumstances attendant on the first discovery and earliest mining of gold in Victoria, and passes on to treat of the different modes in which the gold occurs. The older or basement rocks are of palæozoic age. They are plicated and denuded very much like our own Silurian strata in Wales, Cumberland, and Scotland. They are, as a whole, but little altered, consisting in large measure of sandstones, mudstones, and shales, which now and then pass into harder and somewhat schistose varieties. Across these strata run thousands of quartz veins, which vary in thickness from one-sixteenth of an inch to 100 and 150ft. Although gold has been found in small quantity disseminated between the planes of bedding of the sandstones, it is in these quartz veins that it chiefly occurs *in situ*. It takes many forms—fine flakes or grains floating, as it were, in the quartz, ramifying threads or moss-like aggregations, spangles, thin plates like gold-leaf, well-defined crystals, irregular strings, rough lumps, and large nuggets. How the gold got into the veins is a question on which Mr. Brough Smyth brings forward much argumentation from different writers holding discordant views, but which he does not himself attempt to solve.

Overlying the palæozoic rocks with their quartz veins are "drifts" and alluvial accumulations of different ages. These are very generally auriferous, the gold occurring in detached fragments, varying in shape and size from mere dust up to masses like the "welcome stranger nugget," which weighed upwards of 2280 ounces. There are features of special geological interest in these alluvia, which will be noticed in a second article. The very soil is sometimes full of gold, particularly where it overlies, or slopes from, a quartz-reef. In one place a patch of such soil, about twelve feet square and one foot deep, yielded 30 ounces of gold, even with such rude processes of extraction as were in use in the early days of the gold-fields.

Mr. Smyth arranges the different methods of working gold as follows:—

"(1) *Surfacing*—the washing of the thin covering of earth resting on the tops and sides of the hills in the close neighbourhood of auriferous quartz veins.

(2) *Shallow-sinking*—the obtaining *washdirt* from off the surface of the old claystones, sandstones, and slates, by sinking pits, or making excavations in the valleys and creeks.

(3) *Sluicing and hydraulic mining*—the washing of the auriferous earths, by streams of water, in the gulleys and valleys where recent deposits of auriferous gravels and clays occur.

(4) *Deep sinking*—the obtaining auriferous earths by penetrating the deeper tertiaries.

(5) *Tunnelling*—the obtaining auriferous earths and veinstones by adits.

(6) *Quartz-mining*—the obtaining gold from the mineral veins intersecting the older sedimentary rocks."

The author gives copious details of these different processes as carried on in the various claims and fields. Much of the information so given has necessarily but a local interest, yet its compilation into the present accessible form cannot but prove of much service to those practically engaged in gold-mining in the colony. Some idea of the richness of the Victorian gold-fields may be obtained from the fact that from the first discovery of the precious metal in 1851, up to the end of last year, there had been obtained 36,835,691¾ ounces, estimated as equal to £147,342,767. In the year 1854, just three years after the first discovery of gold, and when the gold-fever was at its height, the number of miners was 65,763. Since that time the numbers have slowly diminished, and in September, 1868, they stood at 63,482. There has been a still more marked diminution in the amount of gold reported. In 1856, the quantity sent out of the colony reached to 2,985,991 ounces, while last year it was only 1,657,498 ounces.

Besides gold, Victoria furnishes other valuable mineral resources. Ores of silver, tin, copper, antimony, zinc, lead, cobalt, bismuth, manganese, and iron occur, some of them in great abundance. Coal, lignite, and bituminous shales are likewise met with; while among the mineral produce of the colony are likewise enumerated the sapphire and the diamond.

The author's official position as Secretary for Mines afforded him excellent opportunities for collecting information regarding the mines in every part of the colony. But such official experience does not necessarily bring with it any practical knowledge of mining, still less any

acquaintance with the geological facts which guide mining operations. Mr. Smyth modestly says of himself: "I wish it to be distinctly understood that I am merely a compiler." But his book abundantly proves that he has a thorough knowledge of what practical mining is, and that he is no mere tyro in geology. A tolerably good test of the accuracy of a man's geological knowledge is often furnished by the way in which he draws a section. He is compelled to put down definitely the notion which he has formed of the structure of a district, or of the relations of certain rocks to each other, and the manner in which he does this may be usually regarded as an indication of the extent of his acquaintance, not merely with the locality in question, but with the fundamental laws of geological structure. At the same time, too, he unconsciously betrays whether or not Nature has gifted him with any trace of the artistic faculty. Now Mr. Smyth's sections are singularly excellent. He procured them from miners, mining companies, geologists, and private friends, and no doubt, in many cases, from his own observations. Everybody who has ever tried to collect sections in this way knows that they come in every conceivable style and scale, usually grossly exaggerated either in length or height. Such were doubtless the sections which arrived at the Victorian Office of Mines. But Mr. Smyth has recast them after his own pattern, and they now appear in a uniform kind of drawing, which reminds one of the artistic finish introduced many years ago into geological section-drawing by the late Sir Henry De la Beche.

It is hardly possible to over-estimate the advantages which must accrue to mining interests in the colony when the Government department of Mines possesses a secretary who is evidently most thoroughly in love with his work, and who is endowed with so much sound scientific knowledge and experience. This book is an eminently practical one. Yet it offers every now and then glimpses into geological questions of the highest interest. To some of these reference will be made in a subsequent article.

ARCH. GEIKIE

OUR BOOK SHELF

Terrestrial Physics.—*Probleme der vergleichenden Erdkunde.* By Oscar Peschel. (Leipzig, 1870.)

THE fundamental thesis of the author, involving his conception of the true province of the science of comparative terrestrial physics, appears to be this:—If a series of maps of the globe, or any part of it, drawn at different times during several centuries, be compared, there becomes obvious a radical want of truthfulness in the older representations; such coast-lines, such mountain-chains, such river-courses are utterly impossible. On the other hand, a modern map convinces us at once of its internal truth. This truth must be founded on some general laws, which must be discoverable by studying the resemblances in the external features of countries; and finally a series of such resemblances distributed over different localities must lead to the discovery of the conditions of their origin.

One example, taken at random, will be sufficient to indicate the author's method of procedure. A comparative study of the localities, where fiords occur, shows—(1) that they are mostly to be found on west coasts, and appear generally associated, rarely single; (2) that they are limited to high latitudes, and excluded from the region confined on both sides of the equator by the isothermal line of 10° C.; (3) that they are all within the region of rainfall during the whole of the year. Hence the general law is deduced, that fiords owe their origin principally to certain climatic conditions, viz. a low temperature, a maximum amount of aqueous deposition, and protection from the drying influence of easterly winds.

Now, we can well admit the possibility, or even probability, that continued actual observations may lead to similar conclusions; but in the mean time we are at a loss to understand how rain or isothermal charts, representing most recent conditions, can be applied to explain phenomena which the author himself thinks must have happened so long ago, that the time would have to be reckoned by hundreds of thousands of years.

M. Peschel, as it appears from his own admissions, has never left his study to observe the phenomena on which he reasons. He has collected, extracted, compiled, compared, and—generalised. This is not the legitimate approach to Nature's secrets, and consequently the author's work, although written in a masterly style, leaves us comparatively in the dark. It is the ingenious pleading of a lawyer for the cause he has undertaken, rather than the transparent and triumphant language with which the genuine student of Nature proclaims his discovery to the world. B. L.

Cinchona Plantations in Java. *Die Chinacultur auf Java.* Von J. W. Van Gorkom, ans dems Hollandischen übertragen von C. Hasskarl. (Leipzig, 1869.)

THE efforts of the English Government to establish the quinine-producing plants of South America in our Indian possessions have excited very general interest. Other European Governments are, however, not less alive than our own to the danger of depending any longer solely upon the chance products of the forests of South America for supplies of the most indispensable of medicines. Our neighbours, the Dutch, have for more than twelve years devoted much attention to the regular cultivation of cinchona trees in Java, and although the results obtained hitherto are not so favourable as we should have hoped, there is good reason to believe that the experience now gained will lead to great success in the future. The scale on which the Dutch experiments are being made will be best indicated by the fact that on the 31st March last there were in Java in nurseries and regular plantations nearly a million cinchona plants under cultivation. Besides these, more than 900,000 have been planted in the jungles, but have, unfortunately, owing to a variety of causes, already mostly disappeared. In the present pamphlet M. von Gorkom gives the experience of the Dutch cultivators, as well as a general review of the literature of the subject. Appended to the pamphlet are tables showing the present state of cinchona-culture in Java, the rate of growths of the plants, and the results of chemical analyses of the various species cultivated. Monsieur van Gorkom has had the advantage of having his work rendered into the more generally accessible German language, by a gentleman who has himself taken so distinguished a part in cinchona-culture as to induce a jury of the French International Exhibition of 1867 to confer a gold medal upon him, while assigning to Markham, McIvor, and others silver medals only.

Transactions of the Bremen Scientific Association.—*Abhandlungen des naturwissenschaftlichen Verens zu Bremen.* Vol. 2. part i. (Bremen, 1869.)

AN article by Dr. Foske on the late Professor Trevirarus points out that in some of his works the fundamental ideas of Darwinianism were clearly expressed, long before the theory was explicitly propounded by Mr. Darwin.

We would direct the attention of biologists to a paper in the same volume, by M. Luerssen, "On the influence of red and blue light on the plasma-stream in the hairs of *Urtica* and *Tradescantia virginica*." It appears that the action of red light is to disturb the molecular structure of the protoplasm, and finally to destroy it entirely, while blue and white light act similarly; the blue, however, with somewhat less energy. B. L.

SENSATION AND PERCEPTION.—I.

VERY different meanings have been attached to the words sensation and perception by different writers; and this diversity of meaning is to be met with in physiological as well as in more strictly philosophical works. Yet it is most important that we should come to a definite understanding upon the subject, in order to know whether certain physiologists have been warranted in assigning sensation and perception to different parts of the brain, as functions of separate portions of this principal organ of mind.

The distinct issue raised is, Are physiologists justified in assuming that the so-called sensory ganglia, at the base of the brain, are the centres in which mere unconscious nerve impressions are converted into conscious sensations? are these ganglia, in fact, in any sense, seats of Consciousness?

Almost everyone understands that both sensation and perception, however they may be supposed to differ from one another, are nevertheless conscious states, or modes of consciousness in the special and ordinary acceptation of the term. But there is one distinguished writer, at least, who has most strenuously objected to this limitation, in the case of the word sensation. Mr. G. H. Lewes maintains* that what most other people term mere impressions or unconscious nerve actions, should really be regarded as sensations, and should be entitled also to the attribute of consciousness—not in its more special acceptation, but in accordance with the very general meaning which he attaches to this word. For the sensations and perceptions of other writers—those impressions to which our attention is given—he reserves the single term perception, apparently because he considers there is no fundamental distinction between them. With this latter part of his doctrine, as will be seen, we are disposed thoroughly to agree, though we cannot assent to the propriety of so far revolutionising the meanings of the words sensation and consciousness. The fundamental position which Mr. Lewes assumes, and upon the strength of which he considers it desirable to make such an innovation in the meanings of thoroughly accepted terms is:—"that sensibility is the *property inherent in ganglionic tissue*—the one peculiar 'force' belonging to all nerve centres, as neurility belongs to all nerves."† Now Mr. Lewes himself points out, that the only means of upsetting his argument (which must be otherwise logically irrefutable) is to deny that sensibility is a *property* of ganglionic tissue, and to look upon it as a *function* rather of certain nerve centres. And this really seems to us to be the conclusion most strongly supported by obtainable evidence. Instead of believing sensibility to be the property inherent in ganglionic tissue, should we not rather assign to this some more general characteristic, such as molecular instability, conferring upon it a property of mere *impressibility*—of which sensibility and consciousness are the most specialised modes, dependent upon the organisation and molecular instability of certain nerve centres of the cerebral hemispheres? Mr. Herbert Spencer‡ calls a ganglion cell a *libero-motor* element; because in the most general conception of its property it seems to be a portion of extremely unstable matter, in which the molecular movements imparted to it by the afferent nerve-fibre undergo a prodigious multiplication before producing their ulterior effects.

Just as we meet with this notable exception to the generally received meaning of the word sensation, so also has the word perception been endowed with an altogether special meaning, by that school of philosophers known as Natural Realists: some of them have removed it also from the sphere of consciousness as ordinarily understood. Space will not permit of my showing how they differ amongst themselves in minor shades of meaning: I will only now quote the views of Dugald Stewart. He says:*—"In order to form an accurate notion of the means by which we acquire our knowledge of things external, it is necessary to attend to the distinct meanings of the words *sensation* and *perception*. The former expresses merely that *change in the state of the mind* which is produced by an impression upon an organ of sense (of which change we can conceive the mind to be conscious without any knowledge of external objects); the latter expresses the *knowledge* we obtain by means of our sensations of the qualities of matter." This is an explanation of perception which to most physiologists would appear absolutely meaningless. It seems itself utterly incomprehensible. Stewart conceived perception to be a distinct mental act by which we obtain a "knowledge" of the properties of matter as existing, and in themselves. But, strange to say, this "knowledge" we "obtain by means of our sensations;" even though by the word *sensation* Stewart understood "merely that change in the state of the mind which is produced by an impression upon an organ of sense." How, through such changes in the state of the mind, we are to arrive at an immediate knowledge of the *things* without which, *ex hypothesi*, the changes are not produced, we are at a loss to understand; and neither do we see how it can be reconciled with Stewart's own theories, seeing that, according to him, consciousness "denotes the immediate knowledge which the mind has of its sensations and thoughts, and, in general, of all its present operations." On the one hand, "knowledge" is made to transcend the sphere of consciousness; whilst on the other, it is said that "of all the present operations of the mind, consciousness is an inseparable concomitant."

With these exceptions, the different acceptations of the words sensation and perception are less divergent, inasmuch as nearly all other writers suppose consciousness, in the ordinary meaning of the word, to be an attribute of both states. And if they are both modes of consciousness, then the only further question to be considered is, whether there is any fundamental difference between them, such as would warrant physiologists in assuming the existence of an organic centre for the realisation of sensations, altogether distinct and apart from that whose functional activity gives rise to perceptions; or whether the two words are applicable only to the extremes of a series between whose terms there are the most innumerable and insensible gradations? If the latter view be the correct one, if the difference is one of degree rather than of kind, then we should be much more consistent in regarding sensations and perceptions as arising from the activity of one and the same organ; and from a consideration of this question we may, therefore, derive some help towards the correct interpretation of the results of operations on the brains of certain lower animals, which have hitherto given rise to much discussion amongst physiologists.

Professor Bain has well shown, in his "Emotions and Will," how sensation in its most strict acceptation does insensibly merge into that which is more usually spoken of as perception. He shows that the more "sensation involves cognitive or intellectual processes, the more liable is it to fall under the title of perception." "Some sensations," he says, "are mere pleasures and pains, and little else; such are the feelings of organic life, and the sweet and bitter tastes and odours. Others stretch away into the region of pure intellect, and are nothing as respects enjoyment or suffering; as, for example, a great number of those of the three higher senses." But it seems to us that Mr. Bain stops short of the truth when he says,† "the lowest or most restricted form of sensation does not contain an element of knowledge." It does not contain knowledge, it is true, in its highest sense, involving affirmation and belief, but as a state of consciousness it is

* "Physiology of Common Life" vol. ii. 1859.
† Loc. cit. p. 20. ‡ System of Philosophy, No. 20, 1868.

* Collected works of Dugald Stewart, edited by Hamilton, vol. ii. p. 14.
† Loc. cit. p. 586 (Second Edition).

inseparable from knowledge in its essence, which implies *discrimination of difference or agreement*. We, in common with others, would rather believe that no sensation, not even the simplest, can exist without the elements of cognition being at the same time present in consciousness.

The word perception has, undoubtedly, been used for the most part to signify something which may be termed an intellectualised sensation, and in the purest form of it the amount of mere feeling is reduced to a minimum, whilst the amount of intellectual action involved has undergone a corresponding increase. A perception is a fully elaborated sensation, from which we derive our notion of the nature of an external object—such object being recognised immediately and intuitively, not so much by the mere light of the single present impression, as by the blending of this with revived memories of all other impressions which have, at various times, been related to the one now present. Thus we get a comprehensive notion of the nature of the external object, though a notion which must, to a certain extent, vary with the individual according to the nature of his previous experience. A savage who had never seen gunpowder before, would have a very different notion called up by the sight of it, from that with which a European would be inspired who well knew its composition and properties. To the one it would be a simple black powder, and by him it would be perceived more or less simply as belonging to this category; whilst the other's notion of the same substance would be more complex, containing ideas as to the ingredients of which it is composed, and as to the effects which it is capable of producing by explosion in various ways. But between such states of knowledge, and others which might be regarded as the simplest specimens of mere feelings or sensations, there is not a difference in kind, only one of degree. Any sensation, however simple, can only be recognised as such—can only be revealed in consciousness—inasmuch as it presents a certain quality or qualities, by which it can be differentiated from or classed with previous states of feeling. Therefore even the most simple sensation does necessitate the existence of intellectual activity, since discrimination is the most fundamental mode of intellect. And, in those more complex sensations, generally named perceptions, the only difference, as previously indicated, is that the feeling, as mere feeling, is reduced to its lowest ebb, whilst the amount of intellectual activity, combined in the form of discrimination and memory, has proportionately increased. For by virtue of that association always occurring during the education of the individual between various related sensations, organic and organised relations have been established in the brain, so that a present sense impression rouses simultaneously memories of other past impressions derived from any given object, either by the same or through different avenues of sense; and this blending either actually or potentially of all our past knowledge concerning the same or similar objects with the new impression, goes to constitute our then present perception. "Thus," as we have said elsewhere,* "I see an orange at a distance: this, as an object of visual sense, is simply a rounded yellow area; but past experience has led me to know what are the tactual and muscular sensations usually associated with the sight impressions—how it is really a spherical body with a somewhat rough surface. Then I have learned also that these impressions are usually associated with a certain odour, with a certain taste, a degree of succulence, and certain internal optical characters, including a divisibility into segments, and the possible presence of seeds within. A combination of any of these, or of a host of other revivable impressions, may go to constitute my perception of an orange, and may flash into consciousness more or less simultaneously on the presentation of the object to the visual sense." But as we have previously said, between this comparatively complex resultant, and what would be called a simple sensation, some mere odour or taste, there are other sensations of all intermediate degrees of complexity; and even such simple forms of sensation could not be realised in consciousness without our *knowing* them as sensations possessing such and such characters: to be *known* at all, they must be known qualitatively, and to recognise their qualities is to know them in relation to certain other past impressions which we may have experienced; and thus, in fact, we may look upon it as almost certain, that even the simplest conscious impression can only be known or realised in consciousness so long as intellectual action of some kind is brought to bear upon its recognition.

Hence it may be legitimately maintained, that there is the strongest *à priori* objection to the view which has been so generally held amongst physiologists, that there is an inherent difference between a sensation and a perception, and that there are distinct nerve-centres, by the activity of which such states or acts respectively are called into being. And whilst psychological evidence is thus strongly in favour of the supposition that all sensations, whether simple or complex, do reveal themselves in one organ only, we think we shall also be able to show that physiological evidence is, moreover, quite in harmony with the opinion that the cerebral hemispheres themselves are the sole seats of consciousness, whether for simple sensations or for complex sensations; and that there is no lower organ for "mere sensations" only, as they have been termed—no *sensorium commune* as ordinarily understood, in which impressions reveal themselves in consciousness before impinging upon the cortical grey substance of the cerebral hemispheres.

H. CHARLTON BASTIAN

* "On the Muscular Sense, and on the Physiology of Thinking." (Brit. Med. Journal, May 1869.)

MISTLETOE

WHEN the leaves are rotting on the ground, and the fruit has been converted into cider, the orchards of Herefordshire and Worcestershire still retain something of their verdant hue, and are green with what seems at first to be untimely foliage. But mistletoe cannot be unseasonable at Christmas, and there are those who would be glad to have it in season "all the year round." The supply from the West Midland Counties is practically inexhaustible, for it has been calculated that from 30 to 90 per cent. of the apple-trees are infested by this parasite, two or three boughs of which may sometimes be seen dependent from some old cankered limb. Its presence is at once the cause and the sign of incipient decay. A struggle for life between the tree and its enemy has begun, and, if the pruning-knife or the demands of Christmas do not interfere, the mistletoe will slowly and surely exhaust the branch upon which it grows, penetrating further and further into the wood as the supply of sap recedes, and ever sending forth fresh roots in place of those which were overpowered at first. The severity of the struggle between these seemingly unequal foes may be sometimes seen in the strange fantastic contortions into which the branches twist themselves, and sometimes in the withered aspect which the whole tree wears when, as Shakespeare says, it stands

> Forlorn and lean,
> O'ercome with moss and baleful mistletoe.

The entire existence of this parasite is full of interest, even though the mystery of its birth has been removed. Modern research confirms the accuracy of the old distich which expresses thus its origin:—

> The thrush, when he pollutes the bough,
> Sows for himself the seeds of woe;

and perhaps the increase of mistletoe may be partly attributable to the disuse of its product (bird-lime), and the greater immunity which thrushes in consequence enjoy. But those who desire to do so may easily propa-

gate mistletoe without their intervention. All that is necessary for success is to introduce very carefully a few seeds into a shallow notch made in the bark of an apple-tree, and bind it round delicately with bass or damp moss. The apple-tree is the surest stock, for, though it is found elsewhere, yet there is a certain constancy in the apparent caprice shown by the mistletoe in the selection of its victims. It occurs frequently on the poplar, hawthorn, willow, and lime; never on the beech, holly, cherry, and walnut; rarely on the chestnut and pear, and only in some few known instances upon the oak. Probably the rarity of its occurrence on the oak contributed to the reverence with which, under those circumstances, it was regarded by our British ancestors. To them a mistletoe-oak was a tree beloved of heaven—a symbol of life and death—a promise of renewal of strength to the leafless monarch of the glade. When the New Year's festival came round, the Arch-Druid, clothed in white, mounted the tree, and cut the mistletoe with a golden sickle. As it fell into the white cloth held to receive it, two white bulls also fell to the ground as sacrificial victims; and the prayer went forth from the Druid's lips that God would prosper his gift, and make it a charm potent against poison, and a certain cure for sterility.

It is curious to notice how this traditional connection between the mistletoe and New Year's Day, and a belief in its virtues, have survived among the natives of the Western Marches. In Herefordshire, at any rate, no mistletoe enters into the Christmas decorations of house and church; but on New Year's Eve, many of the old farmers and cottagers still go forth to cut their bough, and hang it up with all solemnity as the clock strikes twelve. Nor are the medical properties of the mistletoe forgotten by them. Before turnips were extensively cultivated, old Tusser's precept was regularly followed:—

> If snowe doe continue, sheepe hardly that fare
> Crave mistle and ivie for them for to spare.

And even now faith in the virtues of the plant (which is in fact a gentle tonic) may here and there be found. "What is mistletoe good for?" asked Dr. Bull of a Herefordshire rustic. "That do depend on what tree it comes from," was the reply. "It be a very fine thing for fits. My father had the 'leptic fits for many years, but nothing never did him no good like mistletoe from the haw, mixed with wood-laurel, and he took nothing else. They do tell me that mistletoe from the maiden ash be a fine thing for convulsives. I know when you get it from the maw-pell it's good for animals. It's capital for sheep as don't go on well at lambing-time, and for cows too. That as comes from the apple-tree and poplins is the best to hang up in the house on New Year's Day for good luck through the year; but a many people use any that comes first. A piece of mistletoe from the haw—*from the haw*, sir—chopped in pieces and given to a cow after calving, will do her more good nor any drench you can give her." Sir Thomas Browne mentions the practice of thus administering it among his "Vulgar Errors," but at least it is one not likely to be attended with evil consequences.

The reason of the exclusion of mistletoe from church decoration may be gathered from what has already been said, and to this we must add, that its appearance there might be likely to suggest something more ardent than "the kiss of peace." But in hall and cottage alike the mistletoe reigns supreme at this season, and in London and other great towns the artisan spends a small portion of his Christmas wages in the purchase of a few sprigs wherewith to decorate his house and bring good luck to its inmates. From Herefordshire and Worcestershire between 200 and 300 tons of mistletoe are annually exported, and during the present week nearly every train from the West Midland district bears with it a truck-load of branches, fraught with we know not what romance, and bright with berries wherein is contained the destiny of the coming year.

*THE MIDNIGHT SKY**

SURELY if ever there were an Astronomy made easy, here it is: if ever there were a sensible Christmas present for a boy, here it is. In fact, it is impossible to commend Mr. Dunkin or the Religious Tract Society too highly for the work which they have jointly produced. It is an honest, scientifically sound, beautiful book, with appeals both to the eye and the mind: one in which the magnificence of the heavens and the deep teachings of modern science go hand in hand, until at last the unscientific reader will certainly find himself deeply interested in the discussion of questions, and the following-out of reasonings, which but a few short years ago were generally supposed to furnish day-dreams to solitary astronomers, who dwelt in towers far removed from the ken of their fellows, and still further removed from their pursuits and interests.

That such a state of things is past and gone, and that the glories of the firmament are now eagerly revelled in by thousands, ay, and even tens of thousands, is in the main owing to the publication of such books as the "Midnight Sky," and the many handy series of star-maps which Mr. Proctor and others have produced.

The book contains carefully drawn views of the midnight sky, at London, looking north and south, for every night in the year. These views are accompanied in each case by an index-map giving the names of the principal stars. In order that these maps may be utilised at any other hour than midnight, Mr. Dunkin has provided the observer with a tabular statement which gives at one view the hour and month when each diagram of the series is available for comparison with the sky. The descriptions appended to these maps are clearly written in a style which will not be found beyond the comprehension of the least scientific reader. Mr. Dunkin next gives a description of the midnight sky of the southern hemisphere, in the months of February, May, August, and November. Following these articles and star-maps, we find an interesting account of the constellations, general notes on the milky way, the magnitudes, scintillation and colour of the stars, analysis of solar and stellar light, the observatories in the southern hemisphere, and remarks on nebulæ and clusters. Notes on the sun, moon, and earth, the major and the minor planets, succeed, and the work is concluded by a full account of meteors and shooting stars, a copious index serving to give increased usefulness to the book.

The Religious Tract Society has done wisely in entrusting the writing of these familiar notes to an astronomer of such high ability as Mr. Dunkin. Not only have we at once a guarantee of correctness in the facts themselves, but there is insured that freedom of style which only an intimate acquaintance with a subject can give, and, in the case of such a far-reaching and intricate science as astronomy, this consideration is of high importance—witness the flabby books written by incompetent men.

In the latter part of the work, which forms a sort of treatise on astronomy, Mr. Dunkin dwells among other matters on solar eclipses, and gives several very interesting anecdotes connected with them which we do not remember to have seen in print before. In the notes on the sun we detect a little hasty writing, which the author will do well to correct in subsequent editions. In the first place the hydrogen is the sun's chromosphere, is not in a state of *combustion* but of *incandescence*; and M. Le Verrier gets credit for an assertion he made in 1860, which, had Mr. Dunkin printed the context, would be evidently absurd, according to our present knowledge. Father Secchi is credited too with having proved satisfactorily the hollow

* "The Midnight Sky." Familiar Notes on the Stars and Planets. By Edwin Dunkin, F.R.A.S., Royal Observatory, Greenwich. Thirty-two Star-maps and other Illustrations, pp. 326. Religious Tract Society.

structure of sun spots, the fact being that Father Secchi has only clumsily followed in the footsteps of others, and has contradicted himself in the process. We might have expected also a little notice of the bearing of the recent work on the theories of the constitution of the sun and with the timid, feeble, faith-lacking tone of many of the more modern orthodox.

Besides the star-maps and key-maps, specimens of which we give, there are excellent telescopic views of the star-cluster in Perseus, the moon, comets, &c., and drawings of Sir

NORTHERN HEAVENS AS SEEN FROM LONDON JANUARY $\frac{1}{2}$5 (MIDNIGHT)

stars, and of the new theory, based on that work, which has been put forward.

But enough of criticism. No; we have a little more. We think the last chapter out of place, or at all events very unhappy in its treatment, and we believe that Bishop Hall would have thought so too, and we commend the following extract from his Contemplations* to the attention of the Religious Tract Society:—"Human learning, well improved, makes us capable of Divine. There is no knowledge whereof God is not the author: He would never have bestowed any, that should lead us away from Himself. *It is an ignorant conceit, that inquiry into nature should make men atheistical.*" This remarkable passage contrasts strongly

KEY-MAP

W. Herschel's forty-foot reflecting telescope, the Royal Observatory in Flamsteed's time and to-day, the great Equatorial in the Royal Observatory, and of many more interesting subjects either astronomical in themselves or connected in some way with the science. From these we have chosen an exquisite wood-cut representing a meteoric shower as seen off Cape Florida. We know no better way of giving our readers an idea of these splendid phenomena visible so rarely, than by placing this plate before them. With our ordinary experience of meteor showers, even including the brilliant one of 1866, it is almost impossible to believe that such a splendid sight should ever have been realised, but the many published accounts which we have, leave no doubt that here also Nature had beggared description

F.R.S.

* Vol. ii. Book I. p. 25.

METEORIC SHOWER AS SEEN OFF CAPE FLORIDA

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his Correspondents. No notice is taken of anonymous communications.*]

Variety and Species.

In a recent number of NATURE I noticed an extract from a paper read before the Literary and Philosophical Society at Manchester, on the subject of variety as distinguished from species. The author suggests the question, "where does species end, variety begin?" From experiments, he finds that the colours in different parts of the wings of insects treated with, in some cases become toned down to a more sombre hue, in others become mixed with the adjoining colour, and that they are in every case smaller. May not these differences be attributed to the effects of a confined and unnatural life. I myself well recollect rearing a Drinker Moth when a boy at school, and obtaining a small, dull-coloured specimen, instead of an insect whose rich brown wings rival in colour those of the well-known "oak-egger." But difference of colour does not constitute the only variety which is noticed in *Lepidoptera*, for position of markings and proportions of colour are equally worthy of notice, though not so obvious to the unaccustomed eye. Take, for example, the common six-spot Burnet (*Zygæna filipendulæ*), of which I know three distinct forms—viz. (1), the ordinary one, with three clear spots; (2), having the spots all connected, forming an ill-defined bar of red down the centre of the upper wings; (3), (a form which I believe to be in general very rarely met with, but of which I have myself captured several specimens), having the red markings of (1) supplied by those of a pale yellow, in both upper and under wings. Now, since these were all captured in one field where the three forms are comparatively common, may it not be more than probable that the difference is not to be denominated a variety, but to be a natural dissimilarity of form; not to be attributed to any physical difference of circumstances, previously to the attainment of the state of "imago," but to a purely natural and unassisted cause? A white horse is not considered a variety because his sire was a bay, nor is the whiteness of a bullock considered a *lusus naturæ* if born from tawny parents. I hope to be able to make experiments during the following year, which may perhaps lead to more conclusive results on this subject. F.

Cuckow's Eggs

I TRUST that, although some time has elapsed since Professor Newton's very able paper on Cuckows' eggs appeared in NATURE, I am not too late to offer a few observations on it, the more so as I have always taken great interest in the breeding of the cuckow. I cannot quite agree with Professor Newton that cuckows' eggs *as a rule* are subject to great variety. The eggs of the Great Spotted Cuckow (*Oxylophus glandarius*) are certainly not subject to much variety; for in a large series from Africa and Spain I have found them closely resemble each other. Of our common cuckow (*Cuculus canorus*) abnormally coloured eggs have several times come under my observation, but I consider them as of very rare occurrence, and in several large series I have seen, but few have struck me as differing much from the usual type.

Of those I possess in my own collection, the most peculiar variety is a large egg, the ground colour of which is a dirty grey, sparingly spotted and blotched with light brown, and somewhat resembling some varieties of the eggs of the Garden Warbler (*Sylvia hortensis*). This egg was found by the late Mr. E. Seidensacher, of Cilli, Styria, in a nest of the creeper (*Certhia familiaris*), with four eggs of the foster-parent, and was sent to prove that the cuckow must have deposited her egg with her bill, as the nest of the creeper was so placed that she could only have got her head in. A German friend of mine, residing near Coblentz, sent me, for inspection, last year, a most peculiar cuckow's egg, which reminds one of that referred to by Salerne. This egg was rather large for that of a cuckow, and of a uniform bluish green colour. He did not, however, state in what nest it had been found.

My own experience in field natural history leads me to confirm the opinion given by Professor Newton, that the same female produces eggs which closely resemble each other; but at the same time I have not found that the same cuckow generally makes use of the same species of bird as nurse for her offspring, and in this I am borne out by several field naturalists with whom I have worked.

My friend at Coblentz wrote to me some time ago, stating that he had observed that the same female cuckow generally produces similarly coloured eggs, and that he had found in a nest of *Turdus merula* a peculiar and abnormally coloured egg of the common cuckow, closely resembling that of the common bunting (*Emberiza miliaria*), and shortly after found in a nest of the Robin (*Sylvia rubecula*), situated close to the blackbird's nest above referred to, another similar cuckow's egg. He further states that the cuckow is not a common bird there, and that he had good reasons for supposing that the two eggs were produced by the same female; also that in 1867 the same thing occurred, when he found peculiarly coloured cuckows' eggs in nests of the Chiffchaff and Willow-wren.

As far as my own experience goes, I cannot testify to the correctness of Dr. Baldamus's theory, as amongst all the cuckows' eggs I have collected, I find scarcely any that resemble those of the foster-parents. I have now before me eggs of our common cuckow taken with the following species, the eggs of which I have with each cuckow's egg, viz.: *Sylvia arundinacea*, *S. rubecula*, *Certhia familiaris*, *Emberiza hortulana*, *Sylvia palustris*, *S. cinerea*, *Motacilla alba*, and *Accentor modularis*, none of which, excepting that found with the eggs of *Sylvia cinerea*, bear any resemblance to the eggs of the foster-parent. The eggs of the American cow bunting (*Molothrus pecoris*) which, like our cuckow, entrusts its offspring to foster-parents, seldom, I believe, resemble those of the foster-parent, and in the instances that have come under my own observation I have found them to differ very widely from the foster-parent's eggs. On the other hand, the eggs of the Great Spotted Cuckow (*Oxylophus glandarius*) are so strikingly similar to those of the common Magpie, in whose nests they are generally placed, that it is often difficult to distinguish them except by handling them, the texture of the shell being very different from that of the magpie's egg. In Spain they are, however, occasionally found in the nests of the Azure-winged Magpie (*Cyanopica Cookii*,) from the eggs of which bird they differ very much. H. E. DRESSER

Physical Meteorology

In Mr. Balfour Stewart's suggestions (NATURE, p. 192) he refers, as an illustration of his method, to a frequently falling barometer in the centre of a cyclone while air is rushing in from every side, and asks, "What can carry off the air if there be not an ascending current in the very heat of the cyclone?" I would therefore ask his consideration of the grounds on which, as I believe, such an "ascending current" *must* there take place on the simple principle that great heat has been evolved.

It is well known—(1) That long-continued and heavy rainfall takes place in any area of low pressure with higher pressure outside of it. (2) That the greater part of the rain which falls, during storms, descends in the front part of the atmospheric depression which attends the storm; and (3) That the rainfall is *proportional* to the suddenness and extent of the fall of the barometer. Now, though mere *sequence* does not *prove* a connection as "Cause and Effect," it certainly *suggests* it if the supposed cause be adequate to produce the effect. Let B represent a certain weight, the latent heat of vapour at (10° Cent.) 50° Fahr. is (Regnault 599°.5 Cent.) = 1079° Fahr. But specific heat of air is to that of water as 0.2375 : 1 (Regnault). Consequently B of vapour condensed would heat B of air $(\frac{1079^{\circ}}{0.2375})$ 4543° of Fahr.

When a warm and very moist equatorial current meets and intermingles with a cold polar current (from the known laws of vapour) the column of air, thus mixed, must deposit a certain amount of moisture. Let us assume the mixed stream to be about 1,000 feet in thickness, and that $\frac{1}{10}$ of an inch of rain falls suddenly on the surface. 1,000 cubic inches of air weigh 310 grains, and $\frac{1}{10}$ cubic inch of water about 25¼ grains. Consequently, the latent heat of this $\frac{1}{10}$ inch of rain would heat the air of the 1,000 feet column $(\frac{4543^{\circ} \times 25\frac{1}{4}}{310})$ 370° of Fahr. which *must* occasion an enormous ascending current of air, thereby producing a sudden diminution of the pressure at the surface, and causing a large influx of air to restore the equilibrium.

We know that "whirlwinds" arise from "local heating" (as in dust-storms or prairie-fires); hence a like effect must result from such local evolution of heat through the condensation of atmospheric vapour, and the heated column of air will ascend (as a whirlwind in the upper strata) *before* the like effects are

produced at the surface.' In his remarks on the great storm (at Nassau, October 1866), Captain Chatfield observed, "that (during the calm) while the vortex of the storm was passing over the harbour, the atmosphere was most oppressive, and the clouds in the zenith appeared to be revolving rapidly." Under certain modifying circumstances, the same *vera causa* will, I believe, account satisfactorily for the phenomena of "hail-storms," "water-spouts," &c. But I am unwilling to trespass too much on your space.

Glenville, Fermoy HENRY HUDSON, M.D.

A Cyclone in England.

IT is so seldom we get a cyclone so well developed in these latitudes, that I have thought the following observations would interest the readers of NATURE.

Noon.	Barometer,	29.678.	Wind, S.S.W.	Estimated force,	4
4 P.M.	,,	29.304.	,, S.W.	,,	9
6 P.M.	,,	29.205.	,, W.	,,	10
9.40 P.M.	,,	29.342.	,, W.N.W.	,,	9
11 P.M.	,,	29.391.	,, N.W.	,,	7

It will be observed the wind began to freshen from the S.S.W. with a falling barometer; it then veered to S.W., W.S.W. to W., the barometer falling the whole time. When the wind arrived at W. the storm was at its height and the barometer a minimum. The wind then veered W. by N., W.N.W. to N.W., gradually becoming less violent, and the barometer rose during that time. The storm lasted about twelve or fourteen hours.

From the above, I deduce that Plymouth must have been in the southern half of the cyclone which travelled eastward; hence, probably, more damage must have been done further north than here.

I should feel obliged by any reader of NATURE living in the North or East of England, giving the results of his observations during the storm. F.R.A.S.

Plymouth, 17th December, 1869.

Lectures to Ladies

I HAVE only just seen the letter in NATURE, signed "M.A.B.," on the subject of the hour chosen for lectures to ladies. I most sincerely hope that the morning hour will be continued. It is certainly to be regretted if this arrangement is inconvenient to ladies engaged in teaching; but to the far larger number who are not so engaged, any other hour would be prohibitory.

In addition to the constant inconvenience entailed on ladies by the necessity (or supposed necessity) of their being "fetched and carried" every time they go out after dark, all ladies living ordinary lives in quiet homes, know very well that it behoves them to get their "occupations" done in the day-time, and that if they began attending courses of lectures in the evening, their fathers, husbands, and brothers would be apt to raise a pretty forcible outcry against the advance of female education.

If I might venture to make a suggestion, it would be that South Kensington is a very long way from everywhere else, and that a more central situation would add very much to the convenience of those who come from a distance. I am sure that no one who attended Professor Huxley's course of lectures just concluded, begrudged the time and trouble it cost them to get there, or thought it anything but well bestowed; at the same time a shorter and more manageable expedition would be a great boon to many. M. T. G.

NOTES

THE Gold Medal of the Royal Astronomical Society has, we are informed, been this year awarded to M. Delaunay, one of the greatest of living mathematicians and astronomers, for his many important investigations. We are sure that English astronomers will hail this award with the liveliest satisfaction.

THE question of Meteorological Standards is, we learn, now occupying the attention of the Royal Society Council. We may hope, therefore, that the revision which has so long been needed will now take place.

THE Lecturers named for the Friday Evening Meetings at the Royal Institution, before Easter, are Prof. Tyndall, F.R.S., Prof. Odling, F.R.S., Prof. Ruskin, Dr. W. B. Carpenter, F.R.S., Mr. W. K. Clifford, Colonel Sir Henry James, F.R.S., Mr. E. J. Reed, C.B., Chief Constructor of the Navy, Prof. Sylvester, F.R.S., Mr. P. W. Barlow, F.R.S, Prof. Rolleston, F.R.S., Prof. Roscoe, F.R.S., and Prof. Huxley, F.R.S. Prof. Tyndall's discourse will be on "Haze and Dust," and will probably be delivered on the 21st of January. Dr. Odling proposes to lecture on "Prof. Graham's Scientific Work;" Dr. Carpenter on "Temperature and Life in the Deep Sea," and Prof. Sylvester on "Chance."

THE Keith Prize of the Royal Society of Edinburgh was awarded on Monday to Professor Tait, for his paper on the rotation of a rigid body about a fixed point.

THE Professorship of Botany in the Royal College of Science, Dublin, is now vacant, Professor Wyville Thomson's resignation having been accepted by the Science and Art Department.

THE following lectures will be given in the course of the present session of the Chemical Society:—On Vanadium, by Dr. Roscoe; on Refraction Equivalents, by Dr. Gladstone; and on the Platinic Ammoniums, by Dr. Odling.

THE subscriptions to the Faraday Monument Fund, received up to Dec. 7, amount to £1,400. The object of the fund is to provide a public memorial to Faraday, and the subscription from one person is not to exceed five guineas.

PROFESSOR CARL VOGT, of Vienna, is actively engaged in the formation of an Anthropological Society for Austria.

DR. S. COULL MACKENZIE has been appointed to the professorship of Hygiene in the Calcutta Medical College.

IN a new quarterly journal devoted to public hygiene, and produced at Brunswick, in Germany, we find a carefully-written article upon English institutions for hygiene, and English factories. There are also contributions upon army hygiene, barrack reform, and drainage. The journal is edited by Prof. Riclam, of Leipzig.

THE Argenteuil Prize has been awarded by the Academy of Medicine of Paris in the following way:—To Mr. Corradi, of Florence, 5,000 francs; to MM. Mallez and Tripier, 2,000 francs; to M. Reliquet, 1,000 francs.

THE General Secretary of the Academy of Vienna has published as a *tirage apart* from the almanack of the Academy, a biographical sketch of Karl Ludwig Freiherr von Reichenbach, who, after a long and distinguished scientific career, died in January last at the advanced age of eighty-one. Dr. Schrötter divides the period of Reichenbach's scientific activity into three parts: the first, that of practical work and exact research, during which he enriched mankind by the discovery of paraffin and creosote; the second, that which he devoted to the study of meteorites, a study in which his enthusiastic mind led him beyond the boundary of accurate science; and, lastly, the time when he gave himself up to the investigation of so-called animal magnetism and the imaginary odic force by which he sought to explain the phenomena he thought he had discovered. Dr. Schrötter rightly concludes, that however far astray Reichenbach may have been led by his odic notions, he earned for himself an honourable place in science, his very errors being those of a highly-gifted man.

WE have received the first part of the volume recording the scientific results of the travels of Baron Claus von der Decken in East Africa, during the years 1857–1865. The materials have been worked up by Peters, Cabanis, Hilgendorf, Ed. von Martens, and Semper, and comprise Mammalia, Birds, Amphibia, Crustacea, Mollusca, and Echinodermata. The part before us is illustrated by thirty-five lithographic plates of great beauty, most of them being carefully and delicately coloured. The second part, which is to contain the Insects and Spiders, has been entrusted to Gerstäcker.

DR. OLDHAM, the president, has communicated to the Proceedings of the Asiatic Society of Bengal some interesting notes on remains found in a Cromlech at Coorg. This Cromlech was

opened out by the order of the Chief Commissioner of Mysore, on the Moory Betta Hill, in North Coorg. The relics consist of small earthenware vessels, as well as several beads and tubes bored through, and evidently portions of necklaces. These last are of the colour of agate, and have circles in white around them, with zigzag pattern in white in the centre.

IN the early part of last year Dr. Francis Day, F.L.S., F.Z.S., was commissioned to examine the important subject of the Indian River Fisheries. The result is the publication of an interesting and comprehensive report. Dr. Day's observations were at first directed to the fresh-water fisheries south of Madras. He personally inspected the Coleroon anicuts, and then extended his researches to the places lying between these anicuts and the sea. Dr. Day commenced his examinations with the Cauvery river, which runs a course of a hundred miles in the Tanjore district, where it gives off four large branches. At the island of Serungum, the Coleroon becomes the main channel. At this point an anicut was erected in order to raise the water to a height of six feet by means of a wall or barrier, to which the native name of anicutta or anicut was applied. It was subsequently found necessary to erect a regulating dam upon the head of the Cauvery. This dam consisted of a flooring across the stream, with a slip at each extremity 76 feet long, 2·4 feet above the low or middle portion. On the northern waterway of this anicut there are sluices with vents 8 feet in width. It is stated that when, during the freshets, the fish cannot surmount the dam, they make their way up the river through these vents. During the last few years the decrease of fish in the Coleroon is said to be considerable, though Dr. Day does not entirely endorse this assertion. The most valuable fish in the Coleroon was formerly the oolum, or sable fish, culpea (alausa), palasah, C. and V.; but since the erection of the anicut they have seldom been found. It is asserted that in 1836 the value of the sable fish captured in the river near Trindinopoly was equal annually to about two lacs (£200,000). They were principally taken for their roe; but when in condition they are described as splendid eating. Unless something is done, this fine fish, and others of value, will become extinct in the Coleroon. Dr. Day points out how necessary it is that some means may be tried to enable the fish to ascend the river above the anicut, that the ova may be deposited in sufficiently deep water.

ACCORDING to the *Boston Advertiser*, an upheaval is taking place in the harbour at Machias port, Maine. Vast quantities of water, mud, and stones are being thrown up to the distance of many feet with a loud rushing noise. During last summer this occurrence was frequently noticed.

A GERMAN translation of Mr. Wallace's work on the Malay Archipelago, by Dr. Adolf Bernard Meyer, has just been published by Westermann of Brunswick.

Mr. M. J. Barrington Ward, B.A., F.L.S., Scholar of Magdalen Hall, Oxford, has been appointed Natural History Master at Clifton College.

WE have to record the appearance of the sixth, seventh, and eighth supplementary volumes of the Annals of the Munich Observatory. The first contains the meteorological observations from 1857 to 1866; the second a similar series taken on the Hohenfreissenberg from 1851 to 1864; and the last, a catalogue of 6,323 telescopic stars between + 3° and + 9° declination which occur in the Munich zone observations, reduced to the commencement of the year 1850, together with comparison of the observations of Lalande, Bessel, Rünker, and Schiellerur.

THE second part of the results of the Geological Survey of the West Indies has just been issued under the title "Reports on the Geology of Jamaica." Pending a complete notice of this important volume, we may mention that it contains in its first thirty-seven pages a general description of the physical geography of the island, with outlines of the different formations. The body of the book consists of the details of the lithological structure of the various districts. Appended to the volume is a report by Mr. Etheridge, Palæologist of the British Survey, on the organic remains. He has not only examined and classified these remains, but has also referred them to their equivalents in the cretaceous and tertiary deposits of Europe. Sir Roderick Murchison, in his preface, calls special attention to the interesting results of Mr. Etheridge's work.

THE Royal Irish Academy have voted the following sums of money out of their special parliamentary grant for scientific purposes:—30*l.* to the Rev. Eugene O'Meara, A.M., to enable him to continue his researches on the Irish Diatomaceæ; 30*l.* to H. Hennessy, F.R.S., to determine the molecular condition of fluids and their motion, when in rotation and in contact with solids; 20*l.* to J. Bailey, to carry out experiments on "Flitch Beams;" 20*l.* to B. B. Stoney, to try experiments on riveted joints. All the reports on these subjects will appear from time to time in the "Transactions and Proceedings of the Academy."

A SERIES of very beautiful photographic negatives has been taken of all the more important antiquities in the Museum of the Royal Irish Academy. The Council of the Academy intend to have these printed from, and the prints to be sold both separately and in series.

WE hope shortly to give an article on a new artificial light suitable for the production of photographic enlargements, by Dr. Van Monckhoven.

THE following is the result of the National Sciences Tripos, at Cambridge, in which the examiners were—J. Hooker, LL.D., W. H. Miller, M.A., O. Fisher, M.A., C. Trotter, M.A., and J. B. Bradbury, M.D. Class I. Ds. Watson, Queen's—Class II. Ds. Kilner, St. John's; Maxwell, King's; Lupton, Trinity; Lees, Trinity; Stirling, Trinity; Simpson, Caius; Calliphronas, Caius.—Class III. Ds. Alliot, Pembroke; Johnson, Jesus; Banham, St. John's; and Colvin, Trinity—equal; Young, Caius. A prize offered by the Professor of Botany has been adjudged to M. J. Barrington-Ward, B.A., Scholar of Magdalen Hall.

WE have received the following note with regard to the Holborn Viaduct:—"The Report of the Engineers, published in the daily papers, entirely endorses the opinion expressed in the note I previously sent you. The only difference between it and my explanation arises from the fact of the insertion in the joints of lead-packing near the outer edge of the stone, which of course exaggerates the evil of a 'concave face.' The variation of temperature which has been dwelt upon as the chief cause of failure is evidently in the opinion of the engineers quite inadequate to account for it."

MR. MELDRUM has kindly forwarded us the following note:—"A strict watch was kept at the Mauritius for meteors during the nights of the 12th, 13th, and 14th November, and the expected shower was seen on the morning of the 14th. Between midnight of the 13th, and 4·40 a.m. of the 14th, 439 meteors were counted at the Observatory, Port Louis, by three observers. Of that number, 427 were seen between 3·20 and 4·40 a.m. Sir Henry Barkly, at his country residence, 7 miles from Port Louis, counted 192 between 3·15 and 4·15 a.m. At my residence, 5 miles from Port Louis, 434 were counted between midnight and 4·40 a.m., by two observers up to 4 a.m., and then by four observers. Between 3 14 and 4·24 we counted 370, and between 3·55 and 4·13, 215. The greatest number seen by Sir Henry Barkly in an interval of five minutes was 33 between 3·55 and 4·0, but he saw only a small portion of the heavens. I have not had time to analyse the observations carefully, but the time of maximum intensity was about 4·09 a.m. The only source of doubt in this subject arises from the circumstance that after 4·15 daylight was setting in. I have no doubt that the radiant

point was somewhere within the sickle of Leo, but I am not sure as to its exact position. Most of the meteors shot westward along the ecliptic, through Gemini and Taurus, but others in all directions. The trains of light and the nuclei were generally white, with a slight tinge of green, but all the prismatic colours were seen. The time of duration of the flight was from the fraction of a second up to 6 seconds, and the longest trains about 40°. At one time gleams of light of various forms appeared in Leo. I had a small hand-spectroscope, but the times of duration were too short for using it."

SCIENTIFIC SERIALS

The *Moniteur Scientifique* for December 1 contains a translation of Dr. Williamson's memoir of the late Professor Graham, which appeared in the first number of NATURE, a review of contemporary physics and astronomy, a long notice of M. Paul Champion's work on the ancient and modern industry of China, and the usual accounts of new patents and meetings of scientific societies. The number for December 15 completes the volume for 1869, and gives elaborate tables of contents. The remaining space is devoted to reports of the proceedings of the Academy of Sciences, abstracts of papers, notices of new publications, and an account of the new development of the trade in false autographs.

The *Revue des Cours Scientifiques* for December 11 contains a translation of an essay by Helmholtz on Goethe as a naturalist and a physicist, an article on the boring of Mont Cenis by M. A. Cazin, and a translation of Professor Williamson's memoir of Graham, contributed to our first number. The greater portion of the number for December 18 is occupied by a translation of a paper on the Centenary of Humboldt, read before the Boston Natural History Society by Professor Agassiz. It also contains lectures on Palæontology by M. A. Gaudry, and an important paper on the Mortality of Women in Labour, by Professor Lorain.

In the *Philosophical Magazine* for this month, Mr. C. Tomlinson, F.R.S., gives an account of Van der Meusbrugghe's important treatise on the Superficial Tension of Liquids, in which the movements of camphor on the surface of water are shown to form a particular case of a general theory. Mr. W. H. Preece contributes a proof of the Parallelogram of Forces, and Dr. Odling a note on Condensed Ammonia Compounds. Professor Kengott's Microscopical Investigation of the Knyahynia Meteorite, and M. Abich's paper on Hailstorms in Russian Georgia (both of which are accompanied by plates), are well deserving of attention.

In the *Chemical News* for December 17, Mr. Edwin Smith describes an interesting series of experiments on the Electrical Phenomena of Plants, suggested by a chapter in Becquerel's treatise. A paper read before the Glasgow Philosophical Society by Mr. R. R. Tatlock, F.C.S., on the Estimation of Iodine and Bromine, with special reference to the Analysis of Kelp, is reproduced. Mr. W. T. Suffolk, F.R.M.S., continues his useful articles on Microscopical Manipulation; and Mr. H. C. Sorby, F.R.S., describes the application of the Spectrum Microscope to the Valuation of Wines. In a paper on the Constitution of the Compounds of Sodium, Mr. J. A. Wanklyn, F.C.S., adduces new arguments in support of his opinion that the metal sodium had a polyvalent character. The books noticed in this number are Dr. Bence Jones's Memoir of Faraday, and a treatise on the Leclanché Battery. Correspondence from Dr. Mennier and Dr. J. H. Gladstone, and Chemical Notices from Foreign Journals, make up the rest of the number.

A Paper by M. Felix Plateau, on the Flight of the Coleoptera, read before the Physical and Natural History Society of Geneva, in September last, has just been published in the *Bibliothèque Universelle et Revue Suisse*. The conclusions arrived at are as follows:—(1), The difference of flexibility between the two edges of the wing are not sufficient to account completely for the phenomena of flight. (2), The wing makes a wide angle with the plane in which it moves. (3), It is deflected more rapidly than it is elevated. (4), The extent of surface of the wing is greater in the movement of deflection than in the movement of elevation. The influence of the elytra, their form and mode of action, as well as some other considerations, are reserved for a memoir which the author hopes to publish shortly.

ASTRONOMY

Oppolzer communicates to the *Astronomische Nachrichten* the following elements of Comet II., 1869:—

τ = Oct. 9·266 Berlin mean time.
π = 139° 1′ 13″
Ω = 311° 27′ 51″ } Mean Eq. 1869-70.
i = 111° 26′ 40″
log. q = 0·09014°

Professor C. H. F. Peters, of Clinton, N.Y., has discovered still another new planet, 9·7 mag., the elements of which are as follows:—

τ = 1869, Oct. 0·0 Berlin mean time.
M = 338° 1′ 47·7″
π = 53° 8′ 20·8″
Ω = 5° 3′ 52·2″
i = 8° 9′ 59·4″
ϕ = 16° 43′ 30·2″
μ = 808″32
log. a 0·428281

SOCIETIES AND ACADEMIES

LONDON

Royal Astronomical Society, December 10. — Second Meeting of Session. Admiral Manners, president, in the chair during the early part of the meeting; afterwards (the president finding his health not sufficiently restored to enable him to remain), Mr. De la Rue, F.R.S., vice-president, took the chair. The minutes of the last meeting were read and confirmed, and thirty-two presents announced, including a magnificent representation of the solar spectrum from France (showing the part beyond the violet end), presented by Mr. Ladd. Mr. Williams, the assistant secretary, then read a series of extracts from an elaborate work on Chinese Astronomy, upon which he has been engaged during the last three years. He exhibited in a very complete and lucid manner the Chinese mode of reckoning time by cycles of sixty years, the several years of each cycle being indicated by certain characters called Kea Tsze. He then showed how any year in ordinary chronology, whether B.C. or A.D., can be represented in the proper cycle, and in its right place in that cycle. He described the division of the heavens into thirty-one parts; three, called "Yuen," of large size; the remainder, called "Suh," representing lunar houses, and very irregular in extent, both from east to west and from north to south. While one, for instance, extended north and south from Perseus to Canopus, another consisted mainly of a few stars in the head of Orion. Other extracts exhibited the correctness of the positions assigned by the Chinese to the equinoxes and the solstices, and the evidence their estimates give respecting the date at which their observations were made. He mentioned *inter alia* that the Metonic Cycle had been known to the Chinese astronomers 2,000 years before Meton's day. The occurrence of the names of our modern asterisms in Chinese records must not be held to indicate the antiquity of our constellation-figures, because it cannot be doubted that the Jesuits taught the Chinese these new names. In fact, the Chinese were led to remodel their system of astronomy according to the instructions of the Jesuits—a misfortune, perhaps, since, although the old system of astronomy had had the disadvantage of being inexact and scarcely intelligible, the change destroyed many of the clues by which we might have found clearer ideas as to what the Chinese astronomers really meant to record.—The Astronomer Royal indicated his high opinion of the value of such researches as those in which Mr. Williams had been engaged. Astronomy is the science which of all others brings most together the past, the present, and the future, and, therefore, all studies of long past eras, even though the astronomical observations then made were comparatively inexact, cannot but have a high value. Mr. Stone, F.R.S., called attention to the general value of the matter brought before the society's notice by Mr. Williams, but expressed his regret that the Chinese records named only the day on which any phenomenon was observed. Mr. De la Rue then mentioned that the greater part, if not all, of Mr. Williams's work, would be printed in the Society's Memoirs.—The Astronomer Royal described an arrangement for correcting atmospheric chromatic dispersion, even simpler than those he had before devised. It had occurred simultaneously to himself and to Mr. Simms, the

optician, and consists simply in giving the eye-glass of an eye-piece such a motion that while the face towards the field-glass presents an unchanged curvature, the other face (plane) is slightly inclined. This is clearly equivalent to the addition of a prism to the eye-glass, only there is no loss of light, as there would be were a separate prism added. The new eye-piece will serve also to correct errors in the centreing of an object-glass.—Professor Cayley discussed certain geometrical relations connected with the problem of determining the place of a body revolving round the sun, from three observations. He remarked that each observation shows that the body lies on a known line. If we take these three lines in space, what the problem really requires is, that we should determine the position of a plane passing through the sun, and intersecting these lines so that a conic through the points of intersection should have the sun in its focus, and the areas between vectoral radii to the points proportional to the two observed time-intervals. He then considered the locus of the orbit-pole, (1) for an assumed eccentricity, (2) for an assumed period, on a stereographic projection of a portion of the sphere—equal in extent to one half, but not actually a hemisphere. The *loci* for poles to *real* orbits—that is, orbits having all three points on one branch—exhibit a singular figure, the true locus having *points d'arrêt* on the bounding-lines of the half-sphere of projection. In answer to questions by the Astronomer Royal, Mr. De la Rue, and Mr. Stone, Professor Cayley indicated that his paper was intended rather as a contribution to the geometry of the problem than to its practical solution.—Dr. Balfour Stewart then read a paper on terrestrial magnetism. After referring to the views he has already published respecting the earth's magnetic character, he indicated his belief that the zodiacal light is a phenomenon of terrestrial magnetism, owing its existence to the magnetic effects produced by the upper air-currents (the counter-trades); these effects not being recognisable, of course, in ordinary observations. He suggested also that the motion of the tidal wave might account for the magnetic variations, whose period corresponds to the lunar diurnal motion. The Astronomer Royal remarked on the complexity of the whole problem of terrestrial magnetism, which he characterised as hardly belonging to the class of subjects usually dealt with by the Society.—Mr. Proctor gave a brief sketch of a new theory of the Milky Way. He regards the galaxy as neither a cloven disc, as Sir W. Herschel opined, nor a flat ring as Sir J. Herschel has suggested, but a spiral of a figure which he indicated as serving to explain all the most striking peculiarities of the Milky Way, as seen upon the heavens.—Another paper by Mr. Proctor, on Great Circle Sailing, and a letter from Lieut. Tupman about the November meteors as seen in Egypt, remained unread owing to the lateness of the hour.

Geological Society, December 8.—Professor T. H. Huxley, LL.D., F.R.S., president, in the chair. The following communications were read:—1. "Notes on the Brachiopoda hitherto obtained from the Pebble-bed at Budleigh Salterton, near Exmouth, in Devonshire," by Thomas Davidson, Esq., F.R.S., F.G.S., &c. The author first described the general characters, and discussed the opinions that have been put forward as to the origin of the pebbles forming this bed. Nearly forty species of Brachiopoda have been obtained from them. The fossils contained in the pebbles have been regarded as of Lower Silurian age; the author considered the great majority of the Brachiopoda to be Devonian. The species identified with Silurian fossils are:—*Lingula Lesueuri* (Rouault), *L. Rouaulti* (Salter), and *L. Hawkei* (Rouault). The species regarded by the author as undoubtedly Devonian (*i.e.* either previously described from Devonian deposits or associated with such species in the same pebble) are twelve in number, namely:—*Spirifer Verneuilii* (Murch), *S. macroptera* (Goldf.) *Athyris budleighensis* (sp. n.), *Atrypa* (*reticularis?*), *Rhynchonella inaurita* (Sandb.), *R. elliptica* (Schnurr.), *R. Vicaryi* (sp. n.), and two undetermined species of *Rhynchonella*, *Streptorhynchus crenistria* (Phil.) *Productus Vicaryi* (Salt.), and an undetermined *Chonetes*. Eight species occurring in the same rock, three of which have been doubtfully identified, are considered by the author to be probably Devonian. The species supposed to be determined are:—*Orthis redux* (Barr.) and *O. Berthosi* (Rouault), Silurian; and *Spirifer octoplicatus* (Sow.), Devonian and Carboniferous, but possibly identical with the Silurian *S. elevatus* (Dalm.) The others are two new species of *Orthis*, and a new *Rhynchonella* (?), and an undetermined species of *Terebratula* (?) and *Strophomena* (?). Finally, the author noticed fourteen species (all new, except *Orchis pulvinata*, Salt.) only known from these pebbles, but which were stated to possess a Devonian *facies*.—Mr. Etheridge agreed with Mr. Davidson as to his determination of the species. He had, however, examined the extensive collection of Mr. Vicary, and, from their general *facies*, he was inclined to assign them to the Middle Devonian and Carboniferous beds. The attribution of the fossils to Upper Llandovery beds was founded on the presence of *Lingula crumena;* but he thought he could give some clue to the locality from which the pebbles had been derived. It had first, from the lithological character of the pebbles, as well as from the fossils, been thought that they were of Lower Caradoc age. He himself assigned the position of the rocks from which the pebbles had been derived to the Hangman group of North Devon. At Anstis Cove, Mr. Tawney had found a series of the same class of fossils in a matrix exactly like that of the pebbles. He had examined the spot, and there recognised an extension of the sandstones of North Devon (the Hangman Grits) on the south coast, and certainly, so far as lithological character is concerned, the rocks are the same as the pebbles. It did not, however, follow that the pebbles came from that particular district, but probably from the denudation of the large tract of country of Devonian age to the north. There are, however, Silurian species in the pebbles, and these he would refer to the denudation of rocks in an area mainly to the south of what is now the Devon coast. The fauna at Budleigh Salterton is essentially British, and not French, though some few species are common to both areas. The bivalves, indeed, were hardly known in France. On the whole, he concluded that the fossils in the pebbles were Devonian, with a slight admixture of Silurian and probably Carboniferous forms, derived from rocks at no great distance from the spot where the pebbles are found.—Professor Ramsay pointed out that in conglomerates it might be expected to find pebbles of rocks of various ages. He commented on the difficulty palæontologists seemed to labour under in determining a fossil if it came out of a pebble instead of from a rock the position of which was definitely known. He adverted to the statement that the beds containing the pebbles had been deposited in the New Red Sandstone sea, whereas Mr. Godwin-Austen had regarded the New Red deposits as formed in large inland lakes; and the local character of the beds supported this latter view.—Mr. Prestwich was glad that some other source had been suggested for the quartzite pebbles. He had found somewhat similar quartzites between Lisieux and Cherbourg, in France.—The President observed that he would like to see the rise of a new race of palæontologists, relying simply on zoological characteristics, and not on geological position. A considerable simplification of our classification would probably result.—Mr. Etheridge briefly replied.

2. "On the relation of the Boulder-clay without Chalk of the North of England to the Great Chalky Boulder-clay of the South," by Searles V. Wood, jun., Esq., F.G.S. The author described the Yorkshire glacial clays as of two kinds—the lower, containing chalk debris, and belonging to the uppermost member of the glacial series in eastern and east-central England; the upper containing chalk sparingly in its lower part, and gradually losing this upwards. On the coast the latter occurs only north of Flambro'. He stated that, palæontologically, the lower and middle glacial deposits closely agree with the crag, and are quite distinct from the deposits at Bridlington, which he placed immediately above the "Great Chalky Clay." The absence of chalk debris in the deposit north of Flambro' has been regarded as evidence of a drift from north to south; but the author stated that the purple clay without chalk extends over much of the north-eastern part of the Wolds, from the sea-level to an elevation of 450 feet, and that outliers of it occur at intervals along the Holderness coast-section as far as Dimlington, forty-two miles south of the northern limit of the Wolds. In the direction of Flambro' and York the clay was said to be destitute of chalk, which would not be the case had the Wolds formed a sea-shore causing a drift from the north to pass either to south-east or south-west. The author described the characters of the great chalky boulder-clay in the eastern and central counties of England, and maintained that the chalk found in it (equal, according to him, to a layer of at least 200 feet over the entire Wold) could only have been detached by the agency of moving ice, which he believed to have covered nearly the whole Wold for a long period. The author stated that boulders of Shap Fell granite are confined to the deposit of clay without chalk; and discussed the means by which they could have been distributed. He ascribed their dispersion to the agency of floating ice during an adequate sub-

mergence of the district. He supposed them to have passed from Shap Fell by what is now the pass of Stainmoor. Thus he ascribed the formation of the "great chalky clay" to the extrusion from the sea-foot of a great sheet of ice, of materials abraded by the latter, the land being depressed 600 to 700 feet below its present level; and that of the clay without chalk and with boulders of Shap Fell granite to deposition during a period of much greater depression (about 1,500 feet), throughout which the sea bore much floating ice. He considered that the "great chalky clay" indicated a long period during which the land, with its enveloping ice, remained stationary, and that during this period, when intense cold prevailed, the arctic fauna of Bridlington became established. He thought that the recommencement of subsidence was indicated by the reddish-brown or brownish-purple sediments of Holderness, in which some chalk occurs. He then indicated the species of mollusca which have occurred in the purple clay without chalk about Scarbro' and Whitby, all of which were said to belong to existing forms, and thus be in accordance with the date assigned by him to that deposit. The molluscan fauna of Moël Tryfane was referred to by the author, who stated that he regarded it as belonging to the period of emergence from the deepest depression during which the clay without chalk was assumed to have been deposited, *i.e.*, to the earliest part of the post-glacial period, to which the stratified drifts of Scotland are referred by Mr. A. Geikie. Mr. Gwyn Jeffreys had found the shells of Kelsea and elsewhere in Yorkshire to be mainly arctic; and Mr. Prestwich, in his paper on the boulder-clay near Hull, had first pointed out their glacial character. In the late dredgings in H.M.S. *Porcupine* several of the species before known as fossil at Bridlington, but not as existing in the British seas, had been discovered. In fact, he believed that the Bridlington species, with but few exceptions, had now been found in the British seas. Similar species had also been found in the boulder-clay in Scotland. Prof. Ramsay was pleased to find the author's views so closely correspond with his own published some years ago as to the glacial phenomena of North Wales, though based on another part of the country. He thought that shells might be found by careful search in the low-lying boulder-clay in other places than those enumerated, as they had been discovered in the western part of England. Mr. Prestwich, though inclined to accept the divisions of the boulder-clay in Yorkshire as suggested by the author, was not so clear as to his divisions in the south. He thought the presence of chalk in the clay might be traced to the contiguity of the outcrop of the chalk stratum. The shells being to a very great extent recent, the grouping might be due to accidental or local circumstances. The Chillesford clays, in his opinion, mark the commencement of the great glacial period. Mr. Etheridge suggested that *Nucula Cobboldiæ*, *Cardita similis*, and some other shells not found in the British seas, proved the arctic character of the Bridlington fauna. Sir Charles Lyell remarked that if the fauna of the lower and middle glacial really corresponded so closely with that of the crag, it afforded a strong argument against their being of the same age as the Bridlington beds. Perhaps, eventually, some palæontological connection might be traced throughout the series, and a chronological scale established. The President suggested a difficulty in the marine transport of ice from Shap Fell to Bridlington, not only from the wind blowing rarely in the necessary direction, but from the current caused by the great submerged ridge also tending to carry any bergs in another direction. He thought the transport by sheet-ice more probable. The Rev. J. L. Rome had traced the Shap granites over the valley of the Eden, across Stainmoor, to the Yorkshire side. There might have been difficulties in their transport, but there they are. Though they were found in Teesdale, yet the intervening ridge of millstone-grit, 2,000 feet, had prevented them finding their way into Swale Dale. Mr. Searles V. Wood, jun., stated that he had relied on Mr. Gwyn Jeffreys's works for his classification of the shells as being arctic or otherwise. He regarded the succession of the various members of the glacial series as well established, and as borne out also by the molluscan remains. He utterly repudiated the notion that the Chillesford, Bridlington, and Kelsea Hill beds were on the same horizon. He believed the whole of the Scotch beds to be newer than those of England. He quoted Professor Phillips as suggesting a change in the elevation around Shap Fell since the dispersion of the boulders, and offered as his own explanation of the hypothesis, that the passes by which the boulders travelled were those which, though at the higher levels, were the soonest freed from ice. He thought that the direction of the current was influenced by other causes than the general trend of the rocky dividing ridge.

The following specimens were exhibited to the meeting:—Fossiliferous Pebbles from Budleigh Salterton, exhibited by Professor Tennant and R. Etheridge, Esq.

Zoological Society, December 9.—Dr. E. Hamilton, V.P., in the chair. The Secretary read a list of the more remarkable of the recent additions to the Society's menagerie, amongst which were particularly noticed two gibbons (*Hylobates lar*), deposited by G. S. Roden, Esq. An extract was read from a letter addressed to the Secretary by Capt. G. E. Bulger, C.M.Z.S., correcting an error in a former paper by him on the birds observed at Wellington, in the Neilgherry Hills, published in the Society's Proceedings. Professor W. H. Flower, F.R.S., gave some account of the external characters of the fin-whale, recently stranded in Langston Harbour, near Portsmouth, which he considered referable to the species usually called *Balænoptera musculus*. Mr. Flower concluded his remarks with a sketch of the species of the Balænoid, or whalebone-producing, whales, which occur in the British seas. These, according to our present knowledge of them, appear to be six in number, namely:—*Balæna biscayensis*, *Megaptera longimana*, and *Balænopteræ musculus*, *Sibbaldii*, *laticeps*, and *rostrata*. A communication was read from Surgeon Francis Day, F.Z.S., on the fresh-water fishes of Burmah, being an account of the specimens of this class of animals obtained during a recent inspection of the fisheries of Pegu, and during a short visit paid to the capital of Upper Burmah. A second communication was read from Surgeon Francis Day containing the third part of his critical notes on the fishes of the Calcutta Museum. Mr. G. French Angas gave descriptions of twelve new species of land-shells belonging to different subdivisions of the family *Helicidæ*, from the Western Pacific Islands. Mr. P. L. Sclater read a list of the birds that had bred in the Gardens of the Society during the past twenty years. The total number of species enumerated in this list was 108. Mr. R. B. Sharpe pointed out the characters of a new kingfisher belonging to the genus *Tanysiptera*, which he proposed to call *T. Ellioti*. A communication was read from Mr. Harper Pease on the classification of the molluscs of the genus *Helicter*. A paper was read by Messrs. P. L. Sclater and O. Salvin on birds collected by Mr. W. H. Hudson at Conchitas, near Buenos Ayres, being their third communication to the Society upon this subject. Mr. Sclater exhibited and pointed out the characters of two new species of birds of the sub-family *Synallaxinæ*, proposed to be called *Synallaxis curtata* and *Leptasthenura andicola*. A communication was read from Capt. G. E. Bulger, entitled Notes on Two Animals observed near Wind-Vogel-berg, South Africa. Mr. R. Swinhoe, F.Z.S., read a paper on the Cervine Animals of the Island of Hainan, Southern China, which he stated to be referable to three species, namely:—*Cervulus vaginalis*, *Cervus* (*Panolia*) *Eldi*, and a Rusine Deer allied to *Cervus hippelaphus*. A communication was read from Mr. W. T. Blanford on the species of *Hyrax* inhabiting Abyssinia and the neighbouring countries, which he believed to be four in number. Dr. J. E. Gray communicated the description of a new species of *Emys*, living in the Society's Gardens, which he proposed to call *E. flavipes*, from an unknown locality.

Mathematical Society, December 9.—Professor Cayley, president, in the chair. Professor H. J. S. Smith communicated a note on the Focal Properties of two Correlative Figures. This paper was an appendix to a former paper by the same author, on the Focal Properties of Homographic Figures. By the term "focal properties" are intended those properties which arise from considering the imaginary circular points at an infinite distance in either figure, and the points corresponding to them in the other figure. These properties appear to be much less varied in their character in the case of two correlative figures than in the case of two homographic figures; and the two following theorems (of which the first is well known) will suffice to give an idea of the general nature of the results:—1. In two correlative figures in space there are always two corresponding tetrahedra, such that three adjacent edges of each are rectangular; the three edges opposite to these being at an infinite distance, and the edges at a finite distance in either figure corresponding to the edges at an infinite distance in the other. 2. If we consider any point in either figure, and its correlative plane in the other, we have two definite planes passing through the point, and two corresponding points upon the plane, which may be called respectively the cyclic planes of the point

and the foci of the plane. If we take any third point in the plane, the angles which its focal radii vectores make with the line joining the foci are equal to the angles which the traces of the corresponding planes upon the cyclic planes make with the line of intersection of those two planes. These theorems suppose only that in the two correlative figures the plane at an infinite distance in either figure answers to a point at a finite distance in the other. Mr. Tucker (Hon. Sec.) read a proof (by Mr. M. W. Crofton, F.R.S.) of Gauss' Theorems and Napier's Analogies. The proof, a purely geometrical one, was extremely neat and simple. The perpendicular bisector of the base is produced to meet the external bisector of the vertical angle, and from the point of intersection (P) arcs are drawn perpendicular to the sides containing the said vertical angle. This point (P) is also connected by arcs with the extremities of the base; the results readily follow from the equality of certain triangles.—Mr. S. Roberts, M.A., gave an account of a short paper On the Order of the Discriminant of a Ternary Form. The main theorems, the author states, have been geometrically obtained by, and are due to, Professor Cremona (Mr. Roberts' paper contains an analytical proof of them), and relate to the influence of common multiple points on the number of double points of a pencil or involution of curves. The method employed was applied to the determination of the discriminant of a ternary form when certain of the terms are wanting, viz. the form $(x, y)^p(x, z)^q$. The communication also had reference to a paper on Discriminants, by Dr. Henrici, published in the Society's Proceedings, in which the result had been arrived at *indirectly*, and Mr. Roberts' aim was to clear up an apparent discrepancy in the results obtained by Professor Cremona and Dr. Henrici. The latter gentleman joined in a discussion on the subject.—The President gave an account of his investigations on the centro-surface of an ellipsoid (locus of the centres of curvature of the ellipsoid). The surface has been studied by Dr. Salmon, and also by Professor Clebsch, but in particular the theory of the nodal curve on the surface admits of further development. The principal sections of the surface (as is known) consist each of them of an ellipse counting three times, and of an evolute of an ellipse: the evolute and ellipse have four contacts (twofold intersections) and four simple intersections, but the contacts and intersections respectively are in the different sections real or imaginary. The form of the principal sections then is: a real contact at P in the plane of xz, and a real intersection at Q in the plane of xy; and thus there are an exterior and an interior sheet, but (instead of meeting in a conical point, as in the wave surface) these intersect in a nodal curve QP. The curve has a cusp at Q, and a node at P, thus extending beyond P, but from that point is acnodal, or without any real branch of the surface passing through it. Several simple relations were established, but the reductions were of some complexity.

Syro-Egyptian Society, December 7th.—W. H. Black, Esq. in the chair. Mr. Bonomi read a paper on the defacement of the name and figure of the god Amon on all Egyptian temples, obelisks, and statues, during the reign of the successor of Amnnohph III., and the subsequent restoration of both during the reign of Rameses II. Mr. Bonomi conjectures that the amount of skilled labour and expenses of scaffolding necessary to effect these changes prove that they were considered of great importance in a religious point of view; and he stated that there was scarcely a public or private collection of Egyptian antiquities in Europe that could not furnish examples of it. The beautiful drawings and photographs exhibited by Mr. Bonomi, to illustrate the subject, enhanced the interest of his able paper.

Institution of Civil Engineers, December 14.—Mr. Chas. Hutton Gregory, president, in the chair. The paper on Ocean Steam Navigation, with a view to its future development, by Mr John Grantham, M. Inst. C.E., partly read at the meeting on the 7th inst., was concluded; and a brief abstract of the whole is now given. The author contended that steam-ships could be employed more extensively on routes partially occupied by them, and on others where regular steam-lines had not yet been established. Rapid and regular voyages both for passengers and goods were now fully appreciated, while the greatly-increasing intercourse of all nations furnished freights which would support lines of expensive steam-vessels. He traced the rise of ocean steam navigation, and showed that the route from Liverpool to New York was the principal field on which it was first fully developed. He described the efforts made by the Americans to maintain by steam the prestige so long secured by their sailing ships; gave the reason for the great change that had taken place; and stated that not one American steamer was now running between Europe and America. Some of the causes of this were to be found in the fact, that iron ships, worked by the screw propeller, could alone be employed successfully, and that such ships in America were too expensive, both in their construction and in their working, to enable them to compete with English vessels. The form of, and various improvements in, the boilers and the engines were described, showing that a much higher pressure of steam was now employed, that the expansive system and surface condensation were at present considered essential to success in economising fuel, and that the amount of coals consumed had in the best vessels been reduced to 2¼lb. per indicated horse-power per hour, but it was anticipated that a reduction to 2lb. might soon be attained. A map on Mercator's projection was exhibited, indicating the principal ocean routes in connection with the trades between Great Britain and the rest of the world; and the improved system by great circle sailing, as recommended by Mr. Towson, of Liverpool, was described. A table was also exhibited of the relative distances between London and Liverpool, and the various ports shown on the map, both by long sea, and by the Suez Canal and the Pacific Railroad; from which it appeared that, as regarded the Northern Hemisphere, a great saving of distance and time would be effected. The number of ocean steam-ships now working in connection with this country was stated to be 364. The performances of the best ships of various companies were then alluded to, and the result showed that on the North American lines the highest average rate of speed was maintained, but by a large expenditure of fuel; that the Pacific and Colonial Companies' ships gave excellent results, as regarded economy of fuel; and that some new vessels, lately built for the Royal West India Mail Company, seemed to promise the best performances with respect to speed and economy combined. A table taken from the Board of Trade Returns for 1868 showed that, with North America, the tonnage of steam-ships nearly equalled that of sailing ships; but in the Mediterranean trade steam-ships largely exceeded sailing ships. On the other hand, in the regular trades with India, China, and Australia, steam tonnage, by long sea, comprised only about 1 per cent. of the whole. A calculation was then made to show what might be expected if the trade with the East was in future carried through the Suez Canal, and of the number of large steam-fleets which would be required to work it. Some facts were also recorded relative to the effect of the Pacific Railroad, and the probability of letters and passengers from China, Japan, and Western Australia going by that route. It was shown that several days' saving in time would be effected. The author considered that the voyage to Melbourne could be best performed by long sea, as there would be no saving either in distance or in time by way of Suez. The paper held out great prospects of advantage to England and to British shipbuilders, from the immense changes that were apparently about to take place.

Anthropological Society, December 14.—Dr. Charnock, V.P., in the chair. Mr. Wake read a paper on the Race Affinities of the Madecasses. The agreement of the *Hovas* with the other inhabitants of Madagascar in language and customs forbids us to refer the former to a Malayan origin. Moreover, the division into dark and light tribes is found in the Malayan Archipelago, and also in South Africa. Comparison of physical and mental characters, and of customs and superstitions, shows that the dark Madecasses, the Kafirs, and the Papuans, all belong to the same race. By a similar comparison, an analogous affinity between the Hovas, the Hottentots, and the Malays (as representative of whom the paper took the Siamese), can be established. The South African relationship of the Madecasses is supported by the verbal and grammatical affinity of the Malagasy to the Kafir and Hottentot dialects, which are shown to be related between themselves, and also to the Polynesian dialects. The arrangement of peoples on the African area is opposed to the idea of a continental origin of the Madecasses, while their numerous African affinities prevent their being traced to a Malayan source. The Madecasses are more really *autochthonous* than any other race except the aborigines of Australia, and probably Madagascar was connected with both the African Continent and the Malay Archipelago when it was first inhabited by man. The inhabitants of Madagascar possess the domestic ox, sheep, and fowl, and are skilled in the smelting and working of iron. This island was probably (according to the author) the seat of man's primitive civilisation.

DUBLIN

Royal Irish Academy, December 13.—The Rev. Professor Jellett, president, in the chair. Professor Sullivan, Ph.D., read a paper on the Beds of Thenardite of the Valley of Jarama, in connection with climatal effects supposed to be due to the variation of the eccentricity of the earth's orbit, according to the calculations of Messrs. Croll and Moore. The author remarked that M. Adhémar endeavoured to account for change of climate in geological time by the precession of the equinoxes, and the change of position of perihelion. These effects are modified by another astronomical movement—the change in the eccentricity of the earth's orbit. At the instance of Sir C. Lyell, Mr. Stone made some calculations to determine the eccentricity of the orbit in former periods, which Mr. Croll, by the aid of Leverrier's formula, has completed for one million years before 1800 in parts of a unit equal to the mean distance of the earth from the sun. These calculations are given by Sir C. Lyell in the last edition of his "Geology," with the addition of some calculations made by Mr. John Carrick Moore, of the mean temperature of the hottest and coldest months in the latitude of London, supposing other causes which may influence the distribution of heat to remain the same as at present. According to these tables, several periods of extreme temperature should have occurred within the million of years. The most marked of them should occur at 200,000, 210,000, and 750,000 years before 1800, when the mean temperature of the hottest month should be 113° Fahr., and of the coldest 1°·9, 0°·7, and 0°·6 respectively. Professor Tyndall has well pointed out that glaciers require heat as well as cold to produce them, so that extreme temperatures appear to represent the conditions required. These views appear to receive an unexpected support from a phenomenon which, being purely physical, gives more definite results than can in general be obtained from biological ones. In the Valley of the Jarama, a branch of the Tagus which receives the waters of the Manzanares, which flows through Madrid, occurs a series of beds,—thenardite, glauberite, gypsum, and clay,—having a variable thickness of from 16 to 19 metres. Through this the alluvial plain of the river has been cut. The formation of anhydrous sulphate of soda requires that the solution from which the salt separates should be above 35° Cent. or 95° Fahr. This is a temperature which even a shallow lake could only attain if the temperature of the air were considerably above that point. On the other hand, the conditions under which the sulphate of soda could be formed in the first instance requires a low temperature. So that, like glaciers, these beds require great heat and cold, the limits of which are, however, fixed in this case. If the temperature of the hottest month in the latitude of London were 113°, it would be still higher on the plain of Madrid, where even 120° Fahr. in the shade is sometimes even now attained in the locality of these beds. The circumstance which should exist at either of the glacial periods indicated by Mr. Croll's and Mr. Carrick Moore's calculations, would be sufficient to account for those beds; it would be difficult to account for them on the supposition of a period of intense cold. These beds were fully described in a paper by Professors Sullivan and O'Reilly, published in 1863 in Vol. iv. of the *Atlantis*, and afterwards in "Notes on the Geology and Mineralogy of the Spanish Provinces of Santander and Madrid." (London: Williams and Norgate. 1863.) Professors Apjohn and Hennessy took part in the discussion of the paper. J. R. Garstin, A.M., was elected a member of council in the room of Professor Jellett.

PARIS

Academy of Sciences, December 13.—M. H. Sainte-Claire Deville brought under the notice of the Academy a siderostat constructed by the late M. Léon Foucault, and communicated a note upon it by M. C. Wolf. Its action depends upon the production of a perfectly plane mirror, the mode of obtaining which was described in a posthumous paper by M. Léon Foucault, read to the Academy at a recent meeting (see NATURE, p. 177), and its object is to furnish the observer with a perfectly reflected image of any sidereal body for examination by the telescope. A figure of the instrument, which is provided with a clockwork movement, is given in illustration of M. Wolf's note.—M. Laugier remarked upon the employment of the plane mirror, and noticed that Arago had called attention twenty years ago to the advantages which might be derived from it. M. P. A. Favre presented some remarks upon the electric explorer described by M. Trouvé (see NATURE, p. 177), for the detection of metallic substances in wounds, and claimed for himself the invention, in 1862, of an electrical sound for the same purpose.—Marshal Vaillant announced that M. Pasteur was engaged at Trieste in completing a work upon sericulture, and in organising a silk-worm cultivation on a large scale, to be carried on in accordance with his system.—M. Haton de la Goupillière presented a memoir on the system of metallic floodgates which require the minimum of attraction.—A memoir on the dispersion of light, by M. M. Ricour, was communicated by M. Combes. General Morin presented a note by M. H. Morton, on the origin of the luminous band which is observed in contact with the margin of the moon's disc in the photographic pictures of various eclipses. In preparing negative photographs of eclipses, a slight band surrounds the border of the moon's shadow, in which the deposit of silver is more dense than elsewhere, producing a light band in that positive. The author has produced a similar effect by substituting a disc of dark paper for the moon's shadow, and he comes to the conclusion that the phenomenon is simply chemical, and due to the extension, during the development of the plate, of the nitrate of silver from the part protected by the shadow, to a short distance beyond the latter.—A note by M. Hugo Schiff, on the constitution of amygdaline and phloridzine, was communicated by M. Wurtz. The author describes and formulates these substances and their derivatives.—M. E. J. Maumené communicated another memoir on inverted sugar, in reply to M. Dubrunfant, in which he states that none of the latter's assertions are in accordance with experiment. He says that inverted sugar, properly prepared, is a mixture of three optically neutral bodies, which are neither glucose, nor levulose, nor any of the sugars possessing a rotatory power. The fermentation of inverted sugar is accompanied by no elective phenomena.—M. Dubrunfant presented a communication on spectrum analysis applied to the investigation of simple gases, and of their mixtures, in which he described the phenomena presented by various gases and gaseous mixtures under different conditions of pressure, and indicated that the supposed multiple spectra of certain gases are probably due to admixture. Thus it appears to be impossible to obtain hydrogen free from nitrogen, and under a low pressure the spectrum of the latter alone appears.—M. Jos. Boussingault communicated an analysis of the "morallon" emeralds from the mines of Muso, in New Granada.—A memoir was presented by M. Martin de Brettes on the determination of one or more of the following quantities, the others being given: The diameter of an oblong projectile, its weight, its initial velocity, the curve of its trajectory, and the weight of the gun from which it is fired. He gives the formulæ for working out these questions, and indicates their applications to artillery and small arms.—Of two zoological papers, one, by M. Lacaze Duthiers, calls the attention of naturalists to the Harbour of Roscoff, on the north coast of France, as a locality where the so-called *Pentacrinus europæus*, the young form of *Antedon rosaceus*, is to be found in abundance. From his description, the Bay of Roscoff is a paradise for the student of marine zoology.—The second memoir, by M. F. Lenormant, discusses the question of the antiquity of the ass and the horse as domestic animals in Syria and Egypt; and the author states, in opposition to Professor Owen, that the ass is represented very frequently upon the earliest known monuments. The horse, on the contrary, remained unknown in the countries south-west of the Euphrates until the time of the shepherd kings, or about the nineteenth century B.C. M. Milne-Edwards remarked upon this communication that it agreed with the conclusions of zoologists as to the distribution of the species of the genus *Equus;* the ass is to be regarded as an essentially African species, whilst the horse is a native of central Asia and part of Europe. He added that if the shepherd peoples introduced the horse into Egypt, this might throw some light upon their origin. M. Elie de Beaumont remarked that these facts were favourable to the opinion that the existing state of things on the surface of the globe was not of very ancient date.—M. J. Reboux communicated the results of some Prehistoric Archæological researches upon the quarternary beds of Paris, in which he indicated the character of numerous worked flints obtained by him from these beds (from a depth of twelve metres upwards), and gave a long list of animals, the remains of which were found intermixed with the flints.—M. Guérin-Méneville remarked upon the conditions of production of truffles.—A note was presented from M. Namias, describing his employment of hydrate of chloral with beneficial effects at the Hospital of Venice; and another from M. Thuau on a process for the instantaneous lighting and extinction of gas-lamps by means of electricity.

BRUSSELS

Royal Academy of Sciences, November 6.—Various meteorological reports were presented to the Academy, namely: On the Aurora Borealis of the 6th of October, 1869, by MM. A. Quételet and F. Terby; and on storms observed in various parts of Belgium, by MM. A. Quételet, Brauch, Malaise, Dewalque, and Leclercq, the last giving an account of the storm phenomena of the neighbourhood of Liége for the year 1869.—M. C. Montigny communicated a note on the phenomena of coloration of the edges of the sun's disc when near the horizon, in which he referred especially to the appearance of rose-coloured undulations upon the blue arch of the upper margin of the sun, remarked upon certain facts which seem to indicate that these are not produced by atmospheric dispersion or interference, and suggested that they may be due to the protuberances of the chromosphere.—M. E. Morren presented a paper on the contagion of the variegation of plants by means of grafting, both from the stock to the graft, and from the graft to the stock. His observations relate to *Abutilon Thompsoni*, and other species of the same genus.—A note on the wax of straw, by Dr. B. Radziszewski, was communicated by M. L. Henry. This substance, which is analogous to the wax obtained from the sugar-cane, was first observed in a paper-factory at Willebroeck; it is solid, white, insoluble in water, soluble in alcohol and ether, and crystallises from its alcoholic solution in small nacreous scales.—An important memoir, by M. E. Van Beneden, on a new and very large species of *Gregarina* was read; to this we shall revert elsewhere.

BERLIN

German Chemical Society, December 11.—On this date there was a general meeting for the purpose of electing its officers for the year 1870. The following gentlemen were elected:—President: Professor Rammelaberg, with 34 votes against 25 given to Professor Baeyer. Vice-presidents: Professors Baeyer, Hoffmann, Magnus, and Rose. Secretaries and Vice-Secretaries: Dr. Eichermann, Dr. Martius, Dr. Oppenheim, and Dr. Wichelhaus. Treasurer: Mr. Scherinn. Librarian: Dr. Scheibler. Resident Committee: Professor Finkener, Dr. Jacobser, Dr. Kunheim, Dr. Schultzen, and Dr. Vogel. Non-resident Committee: Professors Illasiwetz of Vienna, Hoppe-Scyler of Tuebingen, Kékulé of Bonn, Wislicenus in Zurich, and Wagner in Wurtzburg. Obituary notices of the late honorary member, Professor Graham, and the late member Mr. Beyrick in Berlin, were then read by the President.

December 13.—The following papers were read:—Riebermann and Gräbe on Anturacene-monocarbonic Acid. Baeyer and Emmerling: Synthesis of Indole. Ascher: The Transformation of Angelic into Valerianic Acid. Hofmann and Gentz on Brominated Derivatives of Xylidine and on Dixylyle-guanidine or Meloxylidine. Hofmann on an Isomeric diphenylated Guanidine; and on Sulphocyanate of Xylyle. Hobreller on the Action of Sulphuret of Carbon on Sulphuretted Urea. Naumann: The Law of Avogadro considered as a consequence of the laws by which the movement of gases are regulated. Bel-Trederi on a Third Monochlorinated Phenelo-sulphurous Acid. Cossa on the Constitution of Native Carbonates. Thomsen on the Inaccuracy caused by the use of Favre and Silbermann's Mercury-calorimeter. Rathke on Molecular Combinations. Ladenburg on the Molecular Weight of certain Protoxides and Protochlorides. Fleury on the Action of Pentachloride of Phosphorus on Phenolic Ethers.

VIENNA

Imperial Academy of Sciences, December 2.—Professor Zepharovich presented a fourth instalment of his mineralogical communications, in which he referred to crystals of ullmanite and pyrite, and to the fine twin-crystals of sphene which were found in 1863 on the Rothenkopf. A telegram was communicated from M. Tempel announcing the discovery of a comet at Marseilles on the 27th November. This comet was, in consequence, observed at Vienna by Professor Weiss on the 29th November, and subsequently by Dr. Theodor Oppolzer, who communicated the elements of its orbit and its ephemeris up to the 6th January, 1870, deduced from the observations at Marseilles, Vienna, Leipzig, and Carlsruhe. A memoir entitled "Development of the tetratosymmetrical division of the hexagonal crystal-system, with remarks upon the occurrence of circular polarisation," by M. Aristides Brezina, was communicated by Professor Lang.—Professor von Hochstetter communicated a third paper on the earthquake-wave in the Pacific Ocean, in August 1868, containing observations made in Australia.—M. Schrauf presented the first part of his investigations of Labradorite, containing a description of the mineral and a microscopical examination of its enclosures, and an account of the phenomenon of avanturinisation as presented by it.

DUBLIN

Royal Dublin Society, December 20.—G. J. Stoney, A.M., F.R.S., in the chair. Mr. John Adair read a paper on the Acclimatisation of Plants as a help to the advance of civilisation. The author treated this interesting subject from a practical point of view, leaning rather to the possibility of plants being acclimatised—at least sufficiently so to bear the ordinary winter climate of this country. Dr. Moore, Professor E. Perceval Wright, and others, took part in the discussion of the paper. Mr. A. G. More exhibited from the museum of the society three fine specimens, probably the only three known, of the Blue Mountain Duck of Jamaica (*Pterodroma Caribbæa* Carte) also a large specimen of the Grey Seal (*Halichærus griseus* Nils), which he had shot during the last summer on the coast of Galway. Dr. Emerson Reynolds exhibited a collection of flint arrowheads found in Ireland, and a photograph of a portion of the Giant's Causeway. He mentioned having obtained for the museum a series of the Causeway basaltic columns, consisting of a central column and six encircling ones.

[This abstract reached us too late to be inserted in its proper place.—ED.]

DIARY

THURSDAY, DECEMBER 23.

SOCIETY OF ANTIQUARIES, at 8.30.—Confessionals in the Middle Ages: Abbé Cochet.

THURSDAY, DECEMBER 30.

ROYAL INSTITUTION, at 3—Light: Prof. Tyndall, F.R.S. (Juvenile Lectures.)

BOOKS RECEIVED

ENGLISH.—Catechism of the Decimal, Albert, and Metric Systems: A.W. Bonn (published by the author).—Madam How and Lady Why: Rev. C. Kingsley (Bell and Daldy).—Reptiles and Birds: L. Figuier, edited and adapted by Parker Gillmore (Chapman and Hall).—The Sun: Amedée Guillemin, translated from the French by Dr. Phipson (Bentley).—The Snakes of Australia: Gerard Krefft (Sydney: T. Richards).—Meteorological and Magnetical Observations made at Flagstaff Observatory, Melbourne: Geo. Neumayer. (Through Trübner & Co.)

AMERICAN.—The Trapper's Guide: S. Newhouse.—The New West: Charles Loring Brace.—Agricultural, Qualitative, and Quantitative Analysis: G. C. Caldwell.—Sorghum and its Products: F. L. Stewart.—Elements of Astronomy: C. J. White.—Annual of Scientific Discovery: Dr. J. Knuland.—The Mines of the West: Rossiter W. Raymond.—Report on the Machinery and Processes of the Industrial Arts, &c., at the Paris Exposition of 1867: F. A. B. Barnard.—The Myths of the New World: Dr. Daniel G. Brinton. (Through Trübner and Co.)—An Abstract of Measurements and Examinations of the Solar Eclipse of August 7, 1869. Lecture Notes on Physics. The Total Eclipse of August 7, 1869: all by Prof. Alfred M. Mayer, Ph.D. (From the author.)

FOREIGN.—De la Fécondation Artificielle: Jules Gautar (published by the author).—De l'Abus des Boissons Alcooliques: L. F. E. Bergent.—Die Spectralanalyse: Dr. H. Schellen.—Rapport sur le Progrès de la Chimie Organique pure: L. Micé.—Dictionnaire Botanique: E. G. de St. Pierre.—Die Physiologie: Dr. J. W. Czermak.—Stellung des Menschen: Ludwig Büchner. (Through Williams and Norgate.)

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